CHEMWATCH

Bulletin Board

Contents

APR. 16, 2021

(click on page numbers for links)

REGULATORY UPDATE

ASIA PACIFIC

Australian Pesticides and Veterinary Medicines Authority, Gazette No. 7, 6 April 2021 4

Number of Australian recalls in 2020 tops three figures 4

South Korea publishes English leaflet for implementation of new MSDS rules 6

AMERICA

The use of PFAS substances in many common household and industrial products open industry to potential increased regulation and lawsuits 6

Bill banning plastic exports passes through committee 8

Dudley to notify water system users on unsafe chemical levels 9

Florida's latest regulatory nightmare exposes a glaring national failure 10

EUROPE

EU releases proposals to revise the battery regulation (Directive 2006/66/EC) 11

Protecting our health also means switching to toxic-free food packaging 12

INTERNATIONAL

ISO updates series of standards for nanotechnology 13

REACH UPDATE

Consultation on restriction proposal of lead in outdoor shooting and fishing 15

New proposals and inventions to harmonise classification and labelling . 15

JANET'S CORNER

Web Designer 16

HAZARD ALERT

Biphenyl 17

CONTACT US

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

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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

GOSSIP

Baby born with three penises 21
Study links pesticide exposure to childhood central nervous system tumours 22
Europe's oldest known humans mated with Neandertals surprisingly often 24
Earth lost nearly all its oxygen 2.3 billion years ago 26
HIV vaccine stimulates 'rare immune cells' in early human trials 29
The dinosaur-killing asteroid impact radically altered Earth's tropical forests 31
Academia is often a family business. That's a barrier for increasing diversity 33
These viruses are the most likely to trigger the next pandemic, according to scientists 36
Extraction of organic chemistry grammar from unsupervised learning of chemical reactions 38
Mysterious X-rays are flaring out of Uranus 39

CURIOSITIES

Turtles complete seemingly impossible journey thanks to a hidden 'corridor' through the Pacific 41
People add by default even when subtraction makes more sense 44
A pigment from red cabbage could help turn your favourite foods blue ..46
Seed monopolies: Who controls the world's food supply? 48
What is mRNA? The messenger molecule that's been in every living cell for billions of years is the key ingredient in some COVID-19 vaccines. 52
These endangered monkeys kept getting hit by cars. Scientists had a clever solution 54
Gallium boils at 4,044 degrees F, but will also melt in your hand 55
A spike in Arctic lightning strikes may be linked to Climate Change 58
Mysterious X-rayd are flaring out of Uranus 60
Cutting back on waste is possible—if you can afford it 61

TECHNICAL NOTES

(Note: Open your Web Browser and click on Heading to link to section) ...65
CHEMICAL EFFECTS 65
ENVIRONMENTAL RESEARCH 65
OCCUPATIONAL 65
PHARAMACEUTICAL/TOXICOLOGY 65

CHEMWATCH
Bulletin Board
Contents
APR. 16, 2021

ASIA PACIFIC

Australian Pesticides and Veterinary Medicines Authority, Gazette No. 7, 6 April 2021

2021-04-06

- 6 April 2021 - PDF (707.97 KB) | DOCX (110.28 KB)

Contents

- Agricultural Chemical Products and Approved Labels – 4
- Veterinary Chemical Products and Approved Labels – 12
- Approved Active Constituents – 15
- New agricultural active constituent: bromoxynil butyrate – 18
- New chemical products: Maya Herbicide containing bromoxynil butyrate – 20

Content last updated:

6 April 2021

Content last reviewed:

6 April 2021

APVMA, 6 April 2021

https://apvma.gov.au/node/84111

Number of Australian recalls in 2020 tops three figures

2021-04-02

The number of food recalls in Australia climbed back above 100 in 2020 according to data published by Food Standards Australia New Zealand (FSANZ).

Figures show there were 109 recalls this past year compared to 87 in 2019 and 100 in 2018.

Almost half of the 2020 total was due to undeclared allergens, with 27 because of microbial contamination and 11 due to foreign matter.

Most of the undeclared allergen recalls were due to a customer complaint. Other reasons included routine testing by the government or by the company.

- 6 April 2021 - PDF (707.97 KB) | DOCX (110.28 KB)

•

CHEMWATCH
Bulletin Board
Regulatory Update
APR. 16, 2021

FSANZ has identified five root causes of allergen-related recalls. They are accidental cross contamination either of a raw ingredient or during the final production process; lack of skills and knowledge to fulfil labelling requirements; packaging errors; supplier verification issues or unknown when the business couldn't find what caused the issue or FSANZ didn't get enough information.

Half of the 43 post allergen recall reports in 2020 were due to packaging errors.

Reported corrective actions for undeclared allergen recalls from mid-2016 to 2020 were mostly altering the product label, training staff, amended processing or handling procedures and improved communication.

There are two levels of food recall. A trade recall is when the food has not been available for direct purchase by the public, such as food sold to wholesalers and caterers. A consumer level recall is when the food has been available for retail sale.

Recall trends from 2011 to 2020

Based on an analysis of annual recall statistics for the past 10 years, most food recalls were because of undeclared allergens and microbial contamination.

Recalls for allergens, microbiological and chemical or contaminants show an increasing trend while those for foreign matter are declining.

The most common microbes were Listeria monocytogenes, Salmonella and E. coli. Salmonella related recalls increased in 2020 because of multiple events associated with lettuce products.

Meat products, dairy products and mixed and/or processed foods were the main groups recalled because of Listeria contamination. Eggs and fruits, vegetables and herbs were the top recalled categories for Salmonella and dairy products are more commonly recalled because of concerns with process hygiene, indicated through E. coli testing.

The most common undeclared allergens were milk, multiple allergens and peanut. The main food type associated with recalls because of allergens was mixed and/or processed food. This includes snacks, custard powders and frozen meals. The second most common was confectionery followed by breads and bakery products.

Other recalls in this period were for biotoxin which includes paralytic shellfish toxin, hydrocyanic acid, histamine, aflatoxin and ciguatera and

chemical and other contaminants such as a cleaning or sanitizing agent and heavy metals.

Read More

Food Safety News, 2 April 2021

https://www.foodsafetynews.com/2021/04/number-of-australian-recalls-in-2020-tops-three-figures/

South Korea publishes English leaflet for implementation of new MSDS rules

2021-04-07

It's been almost three months since South Korea implemented the new MSDS rules on January 16, 2021 (ChemLinked news). Because the revised Occupational Safety and Health Act (OSHA) and its supporting regulations that stipulate the requirements on submission of MSDS and CBI non-disclosure application are in Korean, foreign companies have difficulties understanding the compliance duties. The Korea Occupational Safety and Health Agency (KOSHA) under the Ministry of Employment and Labor (MoEL) published a leaflet in Korean this January illustrating the detailed requirements to facilitate the implementation. Recently, the authority translated it into English and made it available on the MSDS platform to a wider global audience. Click here to download the English leaflet.

Recently, the authority translated it into English and made it available on the MSDS platform to a wider global audience.

Read More

Chemlinked, 7 April 2021

https://chemical.chemlinked.com/news/chemical-news/south-korea-publishes-english-leaflet-for-implementation-of-new-msds-rules

AMERICA

The use of PFAS substances in many common household and industrial products open industry to potential increased regulation and lawsuits

2021-04-05

In recent years, there has been growing concern, and regulation, of different chemicals commonly used with many consumer and industrial products sold in the U.S. marketplace. One such group of chemicals gaining increasing scrutiny among federal and state regulators are per- and Polyfluoroalkyl substances (PFAS). PFAS chemicals includes more than 4,000 different chemical compounds and are widely used in everyday products, including stain and water resistant fabrics and carpeting, cleaning products, cookware, paints and fire extinguishing foams. PFAS substances do not easily break down in the environment and have been linked to a number of health problems including cancer, thyroid disease and reproductive issues. The growing scrutiny of PFAS chemicals includes plans for increased regulation, as well as lawsuits against manufacturers, processors, distributors and users of the chemicals.

PFAS have historically been, in large part, unregulated at the federal and state level, but this may change in coming years as federal and state regulators scrutinize the potentially adverse environmental and human impact PFAS substances can cause. Some state agencies have already implemented formal plans to try to regulate the use of these chemicals either through agency regulatory actions or through the courts under existing nuisance or tort law.

Regulators have focused on two PFAS chemicals in particular: Perfluorooctanioc acid (PFOA) and Perfluorooctane sulfonate (PFOS). California state regulators in 2017 added both PFOA and PFOS chemicals to its Proposition 65 list, a law that requires consumer products sold in that state to include a warning if consumers may be exposed to certain listed chemicals. In 2009, the Environmental Protection Agency (EPA) also issued nonbinding advisories for recommended PFOA and PFOS concentration levels in drinking water at which adverse health risks were not anticipated to occur. These advisories remain non-binding.

The EPA announced a PFAS Action Plan in 2019 to address these chemicals and to determine whether binding regulation and enforcement steps are necessary. In January 2021, the EPA issued an advance notice of proposed rulemaking for PFOA and PFOS chemicals that could potentially affect a wide-array of industries and products including, but not limited to, carpet manufacturers, car washes, coatings, paints, and varnish manufacturers, landfills, paper mills, printing facilities where inks are used in photolithography and textile mills. The new Biden-Harris administration has indicated its commitment to addressing the use of PFAS substances and is expected to continue the regulatory steps taken by the EPA during previous administrations.

Copyright Chemwatch 2021 ©

Read More

Mondag, 5 April 2021

https://www.mondaq.com/unitedstates/environmental-law/1053430/the-use-of-pfas-substances-in-many-common-household-and-industrial-products-opens-industry-to-potential-increased-regulation-and-lawsuits

Bill banning plastic exports passes through committee

2021-04-01
The Liberals have been opposed to the bill since it was first introduced, voting against it at second reading.

A bill proposing to ban exports of non-recyclable plastic waste from Canada to foreign countries narrowly passed through a parliamentary committee Wednesday.

Bill C-204, sponsored by Conservative MP Scot Davidson, was adopted by the environmental committee in a 6-5 vote. Liberal MPs accounted for all votes against.

The committee also passed an amendment requiring the government to implement the bill within 12 months of receiving royal assent.

Conservatives were pushing for six months, while the Liberals wanted two years following guidance from Environment Canada officials who said from an "optimistic view," it would take about two years to effectively implement the bill.

The vote on amendments was supposed to take place Monday, but Liberal MPs debated that it should be postponed and were accused by the Conservatives and NDP of filibustering.

The Liberals have been opposed to the bill since it was first introduced, voting against it at second reading.

"They've spent committee reading letters into the record, speaking at great length, which I can only interpret as filibustering," NDP MP Laurel Collins said.

Liberals said they wanted more time to debate the bill because they received several letters from Canadian recycling companies in Ontario, British Columbia and Alberta citing job loss concerns.

According to one letter that Liberal MP Lloyd Longfield received from Rundle Eco Services Ltd.: "Simply put, passage of Bill C-204 will put

A bill proposing to ban exports of non-recyclable plastic waste from Canada to foreign countries narrowly passed through a parliamentary committee Wednesday.

•

CHEMWATCH
Bulletin Board
Regulatory Update
APR. 16, 2021

Canadian recyclers like Rundle ... out of business, our employees will lose their jobs and certain jobs in the service providers ... such as construction companies and transport companies, may be in jeopardy."

Read More

Canada's National Observer, 1 April 2021

https://www.nationalobserver.com/2021/04/01/news/bill-banning-plastic-exports-passes-through-committee

Dudley to notify water system users on unsafe chemical levels

2021-04-07

DUDLEY – The town is about to notify more than 2,300 water system users that their water contains chemicals called PFAS6 at levels deemed unsafe to drink.

Dudley is not the first water supplier mandated to send such a notice and won't be the last as the state Department of Environmental Protection preps for a wave of similar occurrences statewide before the year is out.

The DEP changed its public drinking water regulations for six chemicals in October by lowering the maximum allowable amount from 70 parts per trillion to 20 ppt.

According to DEP records, among the public water systems that have already been found to be serving water above the 20 ppt standard are the Aquarion Water Co. in Millbury, the Hudson Water Supply and the Princeton Town Campus.

These six Per- and Polyfluoroalkyl substances, known as PFAS6, are synthetic chemicals found in consumer products, such as cookware, pizza boxes, stain repellents and firefighting foam.

According to the DEP, some people who consume PFAS6 above 20 ppt may experience adverse effects on the liver, blood, immune system, thyroid, and fetal development. PFAS6 consumption could also elevate the risk of certain cancers.

Pregnant or nursing women, infants and people diagnosed as immunocompromised are considered a "sensitive subgroup." These people are at greater risk and are advised by the DEP not to drink or cook with the water.

These six Per- and Polyfluoroalkyl substances, known as PFAS6, are synthetic chemicals found in consumer products, such as cookware, pizza boxes, stain repellents and firefighting foam.

Read More

Telegram.com, 7 April 2021

https://www.telegram.com/story/news/local/2021/04/07/dudley-alert-water-systemusers-high-chemical-levels/7114294002/

Florida's latest regulatory nightmare exposes a glaring national failure

2021-04-07

As environmental regulators and politicians nervously saluted efforts to prevent the catastrophic release of millions of gallons of wastewater from the aging Piney Point phosphogypsum wastewater storage pond near Tampa, Fla., this week, there was scarce little talk of how we got here. Or of how we'll prevent similar disasters moving forward.

Much like the country's toxic coal ash dumps and pollution-spewing oil and gas wells, the dozens of phosphogypsum stacks across Florida and beyond highlight regulatory failures and chronic injustices that pose catastrophic environmental harms and place disproportionate health and safety risks on Black, Indigenous, and people of color (BIPOC) and low-wealth communities.

And in the case of many of Florida's 25 phosphogypsum stacks, those glaring risks have steadily mounted as state and federal officials ignored signs of troubling failures at outdated facilities plagued by aging infrastructure and lax oversight.

Phosphogypsum waste is created during the process of making phosphoric acid, which is widely used in fertilizers. The toxic, radioactive waste is stored in more than 70 of the mountainous waste piles called "phosphogypsum stacks" in communities in Arkansas, Florida, Idaho, Illinois, Iowa, Louisiana, Mississippi, Missouri, North Carolina, Texas, Utah and Wyoming.

The gypstacks can contain significant amounts of sulfur, arsenic, barium, cadmium, chromium, copper, fluoride, lead and zinc. They also contain radium-226 which has a 1,600-year radioactive decay half-life.

But with mines and processing facilities that manufacture nearly two-thirds of the phosphate fertilizer produced in the U.S., Florida has always stood at the very epicenter of the escalating risks posed by the industry.

They also contain radium-226 which has a 1,600-year radioac-tive decay half-life.

CHEMWATCH
Bulletin Board
Regulatory Update
APR. 16, 2021

And the potentially catastrophic leaks at Piney Point are only the latest in a series of examples of problems at Florida phosphogypsum stacks.

In 2016 a sinkhole in the New Wales gypstack in Florida released 215 million gallons of process wastewater into the Floridan aquifer that provides drinking water for 10 million people.

Read More

The Hill, 7 April 2021

https://thehill.com/opinion/energy-environment/546983-floridas-latest-regulatory-nightmare-exposes-a-glaring-national

EUROPE

EU releases proposals to revise the battery regulation (Directive 2006/66/EC)

2021-04-06

The European Union's Batteries Directive (2006/66/EC) was published on September 26, 2006 and has been in force since September 26, 2008. It stipulates that all batteries or accumulators shall not contain more than 0.0005% (5 ppm) of mercury by weight and portable batteries or accumulators, including those incorporated into appliances, shall not contain more than 0.002% of cadmium by weight.

Batteries with more than 40 ppm lead, 20 ppm cadmium or 5 ppm mercury must also be marked with the chemical symbol for the metal concerned below the crossed-out wheeled bin symbol. The chemical symbol shall cover an area of at least one-quarter the size of the wheeled bin symbol.

The European Commission released a legislative proposal on December 10, 2020 aiming to create a legal framework on the sustainability, traceability and circularity of battery production throughout a product's life cycle. It is an integral part of the Green Deal, the EU's new growth strategy. The Regulation shall apply to all types of batteries and lists the four categories of batteries:

1. Portable batteries
2. Automotive batteries
3. Electric vehicle batteries

Batteries with more than 40 ppm lead, 20 ppm cadmium or 5 ppm mercury must also be marked with the chemical symbol for the metal concerned below the crossed-out wheeled bin symbol.

4. Industrial batteries

Read More

SGS, 6 April 2021

https://www.sgs.com/en/news/2021/03/safeguards-04121-eu-releases-proposals-to-revise-the-battery-regulation-directive-2006-66-ec

Protecting our health also means switching to toxic-free food packaging

2021-04-07

As the world looks to rebuild after COVID, we need to change our approach to the environment, particularly the chemicals and single-use plastics involved in food packaging, writes Frédérique Ries.

Frédérique Ries is a Belgian MEP and vice-chair of the Renew Group. She sits on several committees, including the Committee on the Environment, Public Health and Food Safety.

COVID-19 has hit all countries hard, especially in the European Union, but its impact has been the hardest on those populations that were already vulnerable, who are more exposed to the disease, less likely to have access to quality health care services.

"Building a fairer, healthier world for everyone" – the theme of this year's World Health Day – is entirely appropriate.

"Building a fairer, healthier world for everyone" – the theme of this year's World Health Day – is entirely appropriate.

We need to change many things in our approach to nature, but also in our mindsets, to focus on prevention, which is always a more effective policy than reaction and short-termism.

A typical example is the over-presence of harmful chemicals in our daily lives and the fact in particular that our food comes into contact with many hazardous substances.

There is a wide body of literature on the impacts of harmful chemicals on human health. Many are recognised by the scientific community to interfere with the endocrine system, impair development and impact our nervous and immune systems.

Scientists and NGOs have raised the alarm on the need to remove these chemicals from consumers products and notably food packaging. Indeed, one of the most common ways consumers are exposed to harmful chemicals is through food and beverage, and the products we use to package, store and cook food.

In Europe, over 8,000 chemicals are used in the manufacture of food contact materials, including food packaging, and many have not been adequately tested for toxicity. Regarding plastic packaging specifically, 4,000 chemicals are potentially present and 906 likely present in plastic packaging.

Among those 906 chemicals, 63 were identified as being particularly hazardous for human health.

Read More

Euractiv, 7 April 2021

https://www.euractiv.com/section/energy-environment/opinion/protecting-our-health-also-means-switching-to-toxic-free-food-packaging/

INTERNATIONAL

ISO updates series of standards for nanotechnology

2021-04-05

The International Organization for Standardization (ISO) published a news item on April 1, 2021, entitled "The Science of Tiny Little Things." According to the item, ISO has recently made some revisions and updates to its comprehensive 13-part series of International Standards for nanotechnology. Updated standards include ISO/TS 80004-3, *Nanotechnologies – Vocabulary – Part 3: Carbon nano-objects*, which defines terms and concepts for carbon nano-objects, ISO/TS 80004-6, *Nanotechnologies – Vocabulary – Part 6: Nano-object characterization*, and ISO/TS 80004-8, *Nanotechnologies – Vocabulary – Part 8: Nanomanufacturing processes*. The item states that work is underway "to develop a standard that will consolidate some of the most fundamental terminology in the series." The item lists the following standards that are in the current series:

- ISO/TS 80004-1, *Nanotechnologies – Vocabulary – Part 1: Core terms;*
- ISO/TS 80004-2, *Nanotechnologies – Vocabulary – Part 2: Nano-objects;*
- ISO/TS 80004-4, *Nanotechnologies – Vocabulary – Part 4: Nanostructured materials;*

According to the item, ISO has recently made some revisions and updates to its comprehensive 13-part series of International Standards for nanotechnology.

- ISO/TS 80004-5, *Nanotechnologies – Vocabulary – Part 5: Nano/bio interface;*
- ISO/TS 80004-7, *Nanotechnologies – Vocabulary – Part 7: Diagnostics and therapeutics for healthcare;*
- ISO/TS 80004-9, *Nanotechnologies – Vocabulary – Part 9: Nano-enabled electrotechnical products and systems;*
- ISO/TS 80004-11, *Nanotechnologies – Vocabulary – Part 11: Nanolayer, nanocoating, nanofilm, and related terms;*
- ISO/TS 80004-12, *Nanotechnologies – Vocabulary – Part 12: Quantum phenomena in nanotechnology; and*
- ISO/TS 80004-13, *Nanotechnologies – Vocabulary – Part 13: Graphene and related two-dimensional (2D) materials*.

Read More

Nano and Other Emerging Chemical Technologies Blog, 5 April 2021

https://nanotech.lawbc.com/2021/04/iso-updates-series-of-standards-for-nanotechnology

CHEMWATCH
Bulletin Board

Consultation on restriction proposal of lead in outdoor shooting and fishing

2021-04-07

Learn about the REACH restriction process and how to submit comments to the consultation on the restriction proposal of lead in outdoor shooting and fishing. You can send questions to our experts in advance using this form. No registration required. A live Q&A session will take place during the webinar.

More

ECHA, 7 April 2021

https://echa.europa.eu/-/consultation-on-the-restriction-proposal-of-lead-in-outdoor-shooting-and-fishing

New proposals and inventions to harmonise classification and labelling

2021-04-07

Seven intentions have been received for:

- calcium acetylide; calcium carbide (EC 200-848-3, CAS 75-20-7);
- captan (ISO) 1,2,3,6-tetrahydro-N-(trichloromethylthio)phthalimide (EC 205-087-0, CAS 133-06-2);
- N-(trichloromethylthio)phthalimide (EC 205-088-6, CAS 133-07-3);
- ethanethiol;ethyl mercaptan (EC 200-837-3, CAS 75-08-1);
- sodium peroxometaborate (EC 231-556-4, CAS 7632-04-4);
- methacrylic acid, monoester with propane-1,2-diol (EC 248-666-3, CAS 27813-02-1); and
- 2-hydroxyethyl methacrylate (EC 212-782-2, CAS 868-77-9).

One proposal has been submitted for ethylene bis[3,3-bis(3-tert-butyl-4-hydroxyphenyl)butyrate (EC 251-073-2, CAS 32509-66-3).

Registry of CLH intentions until outcome

ECHA, 7 April 2021

https://echa.europa.eu/registry-of-clh-intentions-until-outcome

No registration required. A live Q&A session will take place during the webinar.

Web Designer

2021-04-16

https://www.pinterest.com.au/pin/507077239302472098/?rcpt=6414113093380753 41&utm_campaign=rtpinrecs&e_t=5fef8a4321f94faeaf25adc63707db9d&utm_source=31&utm_medium=2004&utm_content=507077239302472098&news_hub_id=5153855582737847439

Biphenyl

2021-04-16

Biphenyl (or diphenyl or phenylbenzene or 1,1′-biphenyl or lemonene) is an organic compound that forms colourless crystals and has a distinctively pleasant smell.

Biphenyl occurs naturally in coal tar, crude oil, and natural gas and can be isolated from these sources via distillation. It can also be synthesised by using a Grignard reagent such as phenylmagnesium bromide and reacting it with bromobenzene. Biphenyl is insoluble in water, but soluble in typical organic solvents. The biphenyl molecule consists of two connected phenyl rings. Lacking functional groups, it is fairly non-reactive. It will, however, participate in many of the reactions that are typical for benzene, for example, substitution reactions upon treatment with halogens in the presence of a Lewis acid.

Biphenyl is one of the most thermally stable of all organic compounds. It is combustible at high temperatures producing carbon dioxide and water when combustion is complete. Partial combustion produces carbon monoxide, smoke, soot, and low molecular weight hydrocarbons.

USES [1]

It is an aromatic hydrocarbon with a molecular formula $(C_6H_5)_2$. It is notable as a starting material for the production of polychlorinated biphenyls (PCBs). Biphenyl is an intermediate for the production of a host of organic compounds such as emulsifiers, optical brighteners, crop protection products, and plastics. [1]

ENVIRONMENTAL EFFECTS [2]

Biphenyl dissolves poorly when mixed with water. Most releases of biphenyl to the environment are to air. In air, biphenyl breaks down to other chemicals or settles as dry deposits to water or land. Biphenyl attaches to solid material in water. Microorganisms living in water and in soil break down biphenyl to other chemicals. Because it is a solid that binds to soil, biphenyl is not likely to move through the ground and enter groundwater. Plants and animals may store small amounts of biphenyl.

Biphenyl (or diphenyl or phenylbenzene or 1,1′-biphenyl or lemonene) is an organic compound that forms colourless crystals and has a distinctively pleasant smell.

.

SOURCES AND ROUTES OF EXPOSURE [2,3]

Exposure can occur in the workplace or in the environment following releases to air, water, land, or groundwater. Biphenyl enters the body when people breathe air contaminated with biphenyl or consume food or water contaminated with biphenyl. It can also be absorbed through skin contact. It does not remain in the body due to its breakdown and removal.

Biphenyl may come from many different sources including:

- Industry sources: Releases from industries producing, using, or handling biphenyl, or where it is used as a heat transfer agent (for example, electrical transformers).
- Diffuse sources, and industry sources included in diffuse emissions data
- Sub-threshold facilities: Biphenyl enters the aquatic environment in wastewater effluents from textile mills that use it as a dye carrier; from industrial processes; and from leaking heat exchangers. In addition, biphenyl is released to the atmosphere as a fume during its use as a heat transfer fluid and, to a lesser extent, by volatilisation from soil and water.
- Natural sources: It occurs naturally in trace amounts, mostly in crude oil.
- Consumer products: Where used as a mould retardant in citrus fruit wrappers, in formation of plastics, optical brighteners, and hydraulic fluids. No consumer products should intentionally contain biphenyl. However, it may be found as a contaminant in some foods, and possibly in dyed products such as textiles.

HEALTH EFFECTS [4]

Acute Effects

In workers, acute exposure to high levels of biphenyl has been observed to cause eye and skin irritation and toxic effects on the liver, kidneys, and central and peripheral nervous systems. Symptoms include headache, gastrointestinal pain, nausea, indigestion, numbness and aching of limbs, and general fatigue.

Chronic Effects

In humans, chronic exposure is characterised mostly by central nervous system symptoms, such as fatigue, headache, tremor, insomnia, sensory

CHEMWATCH
Bulletin Board
Hazard Alert
APR. 16, 2021

impairment, and mood changes; however, such symptoms are rare. EPA has not established a Reference Concentration (RfC) for biphenyl. The Reference Dose (RfD) for biphenyl is 0.05 milligrams per kilogram body weight per day (mg/kg/d) based on kidney damage in rats. No data on the carcinogenic effects of biphenyl in humans are available. EPA considers available studies on carcinogenicity in mice and rats to be inadequate. One study of mice orally exposed to biphenyl did not result in any increased incidence of tumours. A second study found tumours in treated and control rats, but their occurrence was not thought to be related to biphenyl administration. EPA has classified biphenyl as a Group D, not classifiable as to human carcinogenicity.

SAFETY [5]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Get medical attention immediately.
- Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Exposure Controls & Personal Protection

Engineering Controls

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

Personal Protection

Personal protective equipment including splash goggles, lab coat, dust respirator (be sure to use an approved/certified respirator or equivalent) and gloves should be worn when handling biphenyl.

In case of large spills, splash goggles, full suit, dust respirator, boots and gloves should be worn. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

EXPOSURE LIMITS [3,5]

- TWA: 0.2 from ACGIH (TLV) [United States] [1995]
- TWA: 1.3 from ACGIH (TLV) [United States] [1995]
- Worksafe Australia: Maximum 8-hour time weighted average (TWA) exposure: 0.2 ppm.

REFERENCES

1. http://en.wikipedia.org/wiki/Biphenyl
2. http://www.epa.gov/chemfact/biphe-fs.pdf
3. http://www.npi.gov.au/substances/biphenyl/source.html
4. http://www.epa.gov/ttn/atw/hlthef/biphenyl.html
5. http://www.sciencelab.com/msds.php?msdsId=9927456

CHEMWATCH
Bulletin Board

Baby born with three penises

2021-04-12

A boy born with three penises is the first-ever reported case of human triphallia, a condition in which three phalluses form during embryonic development.

The child, first seen by doctors as a 3-month-old, was from Duhok, Iraq. He underwent surgery to remove two of the phalluses, which were small projections at the base of the penis and scrotum. The third phallus was in the usual location. According to a case study published in the International Journal of Surgery Case Reports in November, the boy was doing well at a follow-up visit a year after surgery.

Extra, or "supernumerary" penises are a rare congenital condition, occurring only once every 5 million to 6 million live births, according to the researchers. The level of development of these extra phalluses differs in different individuals. In the case of the child in Iraq, the two additional penises contained the erectile tissue, called corpus cavernosum, which becomes engorged with blood during arousal, as well as a tissue called corpus spongiosum, which helps support the urethra, the tube through which urine passes. But the extra penises didn't have urethras. This made surgical removal of the extra organs simple.

PLAY SOUND

Not much is known about why supernumerary penises occur, said John Martin, an anatomy professor at the St. Louis University School of Medicine, who was not involved in the case study. Martin and his colleagues teach anatomy using a body-donation program and once discovered that one of their body donors had diphallia, or two penises. The man, who died at age 84, had two full-size phalluses with a urethral opening between them at their base. The donor didn't make any mention of the condition on his body-donation forms. He had two children, Martin said, but the researchers don't know whether they were biological children or whether any reproductive technologies were necessary for the man to have children.

"He died in the early 2000s, so when he was growing up surgery wasn't an option, perhaps," Martin told Live Science. "It's just very different from today where anything like that would have been detected early on and most likely surgery would have been done."

Extra, or "supernumerary" penises are a rare congenital condition, occurring only once every 5 million to 6 million live births, according to the researchers.

Martin and his colleagues did genetic testing on the donor to see if they could determine the reason for the unusual development. They found several mutations in genes known to be involved in genital development, including some that contribute to forming hairlike structures called cilia on embryonic cells. These cilia are very important in development, Martin told Live Science, because they flutter in specific directions, wafting proteins toward one side or the other of the developing embryo. Abnormalities in the cilia genes have also been seen in other cases of congenital abnormalities, he said, such as situs inversus, in which the organs in the torso are flip-flopped so that they are on opposite sides from their normal positions.

The researchers also found mutations in genes that help regulate the activity of other genes in development and in genes involved in receptors for androgens, hormones that have a masculinizing influence and that are involved in genital development.

Another gene commonly associated with genital development is the quirkily named sonic hedgehog, Martin said, which is important throughout the body for promoting growth during embryonic development.

It's not clear how similar the genetics are between different cases of diphallia or whether these findings apply to the one-of-a-kind case of triphallia. The doctors who treated the Iraqi baby found nothing in the child's family history or medical history, such as exposure to medications or chemicals during pregnancy, that would explain the congenital abnormality. The child was otherwise healthy except for some fluid buildup in the scrotum, which is a common and easily treated condition in infancy.

Originally published on Live Science.

livescience.com, 12 April 2021

https://www.livescience.com

Study links pesticide exposure to childhood central nervous system tumours

2021-04-07

A new study adds to the evidence that pesticides harm children's health.

The study, published in Environmental Research last week, found that children were more likely to develop central nervous system (CNS) tumors

This risk is exacerbated by the fact that farmland and residential land is not always clearly delineated in the state.

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

if their mothers had lived within 2.5 miles of land where pesticides were being sprayed when they were born.

"This study is the first, to our knowledge, to estimate effects for a large number of specific pesticides in relation to CNS tumor subtypes," Julia Heck, a study coauthor and the associate dean for research at the University of North Texas College of Health and Public Service said, as NBC Los Angeles reported.

The research looked at the California Cancer Registry to identify cases of certain cancers in children under six years old, the study explained. They focused on mothers who lived in rural areas and gave birth between 1998 and 2011 to identify 667 cases of childhood central nervous system tumors and 123,158 controls. They then compared these cases to data from the California Department of Pesticide Regulation's (CDPR) Pesticide Use Reporting (PUR) system to identify whether chemicals classed as possible carcinogens by the U.S. Environmental Protection Agency (EPA) had been sprayed within 2.5 miles of the mothers' homes at birth.

One important implication of the study is that the mothers did not have to be directly working in agriculture in order for their children to face dangerous exposure.

"California's agricultural work force numbers more than 800,000, according to state estimates," Dr. Christina Lombardi, study co-author and epidemiologist with the Samuel Oschin Comprehensive Cancer Institute at Cedars-Sinai Medical Center in Los Angeles, told Beyond Pesticides. "In addition to the negative health effects of pesticides on workers there are large numbers of pregnant women and young children living adjacent to treated fields who may experience detrimental health effects as well."

This risk is exacerbated by the fact that farmland and residential land is not always clearly delineated in the state.

"This transition from farmland to residential neighborhoods is abrupt across California, and, of course, constantly changing as farmland is developed," study co-author Myles Cockburn of the University of Southern California told Beyond Pesticides.

The researchers found that some of the chemicals they studied increased tumor risk as much as 2.5 times. Overall, exposure to the pesticides chlorthalonil, bromacil, thiophanate-methyl, triforine, kresoxim-methyl, propiconazole, dimethoate and linuron all increased tumor risk.

This is far from the first study to show that pesticide exposure is a danger to pregnant mothers and children. In fact, researchers have been studying the link between pesticides and childhood cancer since the 1970s, according to NBC Los Angeles.

The report authors called for government action to better protect mothers and children.

"Policy interventions to reduce pesticide exposure in individuals residing near agricultural fields should be considered to protect the health of children," coauthor and UCLA's Fielding School of Public Health epidemiology professor Beate Ritz told NBC Los Angeles.

ecowatch.com, 7 April 2021

https://www.ecowatch.com

Europe's oldest known humans mated with Neandertals surprisingly often

2021-04-07

When some of the earliest human migrants to Europe encountered Neandertals already living there around 45,000 years ago, hookups flourished.

Analyses of DNA found in human fossils from around that time — the oldest known human remains in Europe — suggest that interbreeding between Homo sapiens and Neandertals, who were on the fast track to extinction, occurred more commonly than has often been assumed, two new studies suggest. Both reports appear April 7 in Nature Ecology & Evolution.

Genetic evidence in the new reports indicates for the first time that distinct human populations reached Europe shortly after 50,000 years ago. Neandertals interbred with all the groups detected so far, ensuring that some of their genes live on today in our DNA.

Remains of three H. sapiens individuals unearthed in Bulgaria's Bacho Kiro Cave yielded nuclear DNA containing Neandertal contributions of about 3 to 4 percent, says a team led by evolutionary geneticist Mateja Hajdinjak of the Francis Crick Institute in London. The ancient DNA came from a tooth and two bone fragments radiocarbon dated to between around 43,000 and 46,000 years ago. Stone tools typical of late Stone Age humans were found in the same sediment as the fossils.

The ancient DNA came from a tooth and two bone fragments radiocarbon dated to between around 43,000 and 46,000 years ago.

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

Bottom of Form

"All of the Bacho Kiro individuals had recent Neandertal ancestors, as few as five to seven generations back in their family trees," Hajdinjak says.

Further evidence of ancient interbreeding comes from a nearly complete human skull discovered in 1950 in a cave in what's now the Czech Republic. About 2 percent of the genes in DNA from that fossil, identified as a female's, also come from Neandertals, say evolutionary geneticist Kay Prüfer of the Max Planck Institute for the Science of Human History in Jena, Germany, and his colleagues. Analysis of those DNA segments suggest she also lived around 45,000 years ago.

The H. sapiens fossils in Bulgaria and the Czech Republic aren't the first ones found with bits of Neandertal DNA in their genomes, but they are most likely the oldest. The long Neandertal DNA segments in the eastern European woman, which would have broken into shorter segments in later human generations, suggest she lived a few hundred to a few thousand years earlier than a previously reported 45,000-year-old Siberian man who shared 2.3 percent of his genes with Neandertals (SN: 10/22/14). That find indicated that interbreeding outside of Europe dated to as early as 60,000 years ago. And a Romanian man who lived roughly 40,000 years ago also possessed long stretches of Neandertal DNA, indicating he was four to six generations removed from a Neandertal relative (SN: 5/11/15).

Neandertals went extinct around 40,000 years ago, though their genetic remnants remain — today, non-African people carry, on average, nearly 2 percent Neandertal DNA. Present-day Africans possess a smaller Neandertal genetic legacy (SN: 1/30/20).

Taken together, the new studies suggest that some early human entrants to Europe had a long-lasting impact on our DNA while others hit genetic dead-ends. Bacho Kiro humans represent a newly identified population of ancient Europeans with genetic ties to present-day East Asians and Native Americans, but not western Eurasians, Hajdinjak's group says. Like the ancient Romanian and Siberian men, the Czech Republic woman contributed no genes to H. sapiens that lived after around 40,000 years ago.

"It is remarkable that the Bacho Kiro finds could represent a population that was spreading 45,000 years ago at least from Bulgaria to China," says evolutionary geneticist Carles Lalueza-Fox of the Institute of Evolutionary Biology in Barcelona, who did not participate in either new investigation.

If H. sapiens and Neandertals regularly interbred as the latter population neared its demise, then relatively large numbers of incoming humans accumulated a surprising amount of DNA from smaller Neandertal populations, Lalueza-Fox suspects. After 40,000 years ago, additional migrations into Europe by people with little or no Neandertal ancestry would have further diluted Neandertal DNA from the human gene pool, he says.

Those humans made distinctive stone and bone tools and served as ancestors of present-day Europeans, Hajdinjak suggests. At Bacho Kiro Cave, for instance, newly recovered DNA from a roughly 35,000-year-old H. sapiens bone fragment displays a different makeup than that of the cave's earlier human inhabitants. This individual contributed genes mainly to later populations in Europe and western Asia, Hajdinjak says.

sciencenews.org, 7 April 2021
https://www.sciencenews.org

Earth lost nearly all its oxygen 2.3 billion years ago

2021-04-08

Earth's transition to permanently hosting an oxygenated atmosphere was a halting process that took 100 million years longer than previously believed, according to a new study.

When Earth first formed 4.5 billion years ago, the atmosphere contained almost no oxygen. But 2.43 billion years ago, something happened: Oxygen levels started rising, then falling, accompanied by massive changes in climate, including several glaciations that may have covered the entire globe in ice.

Chemical signatures locked in rocks that formed during this era had suggested that by 2.32 billion years ago, oxygen was a permanent feature of the planet's atmosphere.

But a new study delving into the period after 2.32 billion years ago finds that oxygen levels were still yo-yoing back and forth until 2.22 billion years ago, when the planet finally reached a permanent tipping point. This new research, published in the journal Nature on March 29, extends the duration of what scientists call the Great Oxidation Event by 100 million years. It also may confirm the link between oxygenation and massive climate swings.

It also may confirm the link between oxygenation and massive climate swings.

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

"We only now start to see the complexity of this event," said study co-author Andrey Bekker, a geologist at the University of California, Riverside.

Establishing oxygen

The oxygen created in the Great Oxidation Event was made by marine cyanobacteria, a type of bacteria that produces energy via photosynthesis. The main byproduct of photosynthesis is oxygen, and early cyanobacteria eventually churned out enough oxygen to remake the face of the planet forever.

The signature of this change is visible in marine sedimentary rocks. In an oxygen-free atmosphere, these rocks contain certain kinds of sulfur isotopes. (Isotopes are elements with varying numbers of neutrons in their nuclei.) When oxygen spikes, these sulfur isotopes disappear because the chemical reactions that create it don't occur in the presence of oxygen.

Bekker and his colleagues have long studied the appearance and disappearance of these sulfur isotope signals. They and other researchers had noticed that the rise and fall of oxygen in the atmosphere seemed to track with three global glaciations that occurred between 2.5 billion and 2.2 billion years ago. But strangely, the fourth and final glaciation in that period hadn't been linked to swings in atmospheric oxygen levels.

The researchers were puzzled, Bekker told Live Science. "Why do we have four glacial events, and three of them can be linked and explained through variations of atmospheric oxygen, but the fourth of them stands independent?"

To find out, the researchers studied younger rocks from South Africa. These marine rocks cover the later part of the Great Oxidation Event, from the aftermath of the third glaciation up to about 2.2 billion years ago.

They found that after the third glaciation event the atmosphere was oxygen-free at first, then oxygen rose and dropped again. Oxygen rose again 2.32 billion years ago — the point at which scientists previously thought the rise was permanent. But in the younger rocks, Bekker and his colleagues again detected a drop in oxygen levels. This drop coincided with the final glaciation, the one that hadn't previously been linked to atmospheric changes.

"Atmospheric oxygen during this early time was very unstable and it went up to relatively high levels and it fell down to very low levels," Bekker said. "That's something we didn't expect until maybe the last 4 or 5 years [of research]."

Cyanobacteria vs. volcanoes

Researchers are still working out what caused all these fluctuations, but they have some ideas. One key factor is methane, a greenhouse gas that's more efficient at trapping heat than carbon dioxide.

Today, methane plays a small role in global warming compared with carbon dioxide, because methane reacts with oxygen and disappears from the atmosphere within about a decade, whereascarbon dioxide sticks around for hundreds of years. But when there was little to no oxygen in the atmosphere, methane lasted a lot longer and acted as a more important greenhouse gas.

So the sequence of oxygenation and climate change possibly went something like this: Cyanobacteria began producing oxygen, which reacted with the methane in the atmosphere at the time, leaving only carbon dioxide behind. This carbon dioxide wasn't abundant enough to make up for the warming effect of the lost methane, so the planet started to cool. The glaciers expanded, and the surface of the planet became icy and cold.

Saving the planet from a permanent deep-freeze, though, were subglacial volcanoes. Volcanic activity eventually boosted carbon dioxide levels high enough to warm the planet again. And while oxygen production lagged in the ice-covered oceans due to the cyanobacteria receiving less sunlight, methane from volcanoes and microorganisms again began to build up in the atmosphere, further heating things up.

But volcanic carbon dioxide levels had another major effect. When carbon dioxide reacts with rainwater, it forms carbonic acid, which dissolves rocks more quickly than pH-neutral rainwater. This faster weathering of rocks brings more nutrients such as phosphorus into the oceans. More than 2 billion years ago, such a nutrient influx would have driven the oxygen-producing marine cyanobacteria into a productive frenzy, again boosting atmospheric oxygen levels, driving down methane and starting the whole cycle again.

Eventually, another geological change broke this oxygenation-glaciation cycle. The pattern seems to have ended about 2.2 billion years ago when the rock record indicates an increase in organic carbon being buried, which suggests that photosynthetic organisms were having a heyday. No one knows exactly what triggered this tipping point, though Bekker and his colleagues hypothesize that volcanic activity in this period provided a new influx of nutrients to the oceans, finally giving cyanobacteria

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

everything they needed to thrive. At this point, Bekker said, oxygen levels were high enough to permanently suppress methane's oversized influence on the climate, and carbon dioxide from volcanic activity and other sources became the dominant greenhouse gas for keeping the planet warm.

There are many other rock sequences from this era around the world, Bekker said, including in western Africa, North America, Brazil, Russia and Ukraine. These ancient rocks need more study to reveal how the early cycles of oxygenation worked, he said, particularly to understand how the ups and downs affected the planet's life.

Originally published on Live Science.

livescience.com, 8 April 2021

https://www.livescience.com

HIV vaccine stimulates 'rare immune cells' in early human trials

2021-04-07

A new vaccine for HIV is raising excitement after its first in-human trials showed 97% success at stimulating a rare set of immune cells that play a key role in fighting the virus.

The vaccine approach is a new attempt to head off the fast-mutating human immunodeficiency virus, which has eluded vaccines in the past because it attacks part of the immune system directly and is good at evading other immune defenses. Developed by scientists at Scripps Research in San Diego and the nonprofit International AIDS Vaccine Initiative (IAVI), the vaccine is in Phase I clinical trials and has been tested in only 48 people so far.

However, the results of the trial generated excitement, especially because Scripps and IAVI will now partner with Moderna to make an mRNA version of the vaccine — a step that could lead to faster vaccine availability, according to Scripps Research.

"With our many collaborators on the study team, we showed that vaccines can be designed to stimulate rare immune cells with specific properties, and this targeted stimulation can be very efficient in humans," William Schief, an immunologist at Scripps whose laboratory led the vaccine development, said in a statement. "We believe this approach will be key

"We believe this approach will be key in making an HIV vaccine and possibly important for making vaccines against other pathogens."

in making an HIV vaccine and possibly important for making vaccines against other pathogens."

A challenging vaccine

HIV vaccine research started in the 1980s, not long after the discovery of the virus that causes AIDS. However, progress has been slow, with only one two-vaccine combination — tested in the Thai RV144 trial — shown to have an effect. The results of that trial, released in 2009, showed a 31% reduction in infection due to the vaccine combination. That is too low to submit for regulatory approval, but the vaccine developers continue to study what does and does not work about the combination. Follow-up research suggested that this limited protection faded after about a year.

The virus is a difficult target for vaccination because it's expert at evading the body's antibody response. Antibodies are proteins that are primed to recognize a foreign invader, or antigen, and bind to that invader right away, neutralizing it or tagging it for destruction by other immune cells. Vaccines work by presenting a dead or harmless antigen to the immune system, allowing antibodies to develop without the threat of disease. But because HIV mutates quickly to avoid antibodies, a highly effective vaccine has yet to be developed.

The new approach focuses on a rare set of antibodies known as broadly neutralizing antibodies. These antibodies can bind to the spike proteins on HIV, a part of the virus that doesn't vary much among different strains. The spike protein is the key the virus uses to enter cells, so it can't mutate much without locking the virus out.

The problem is that broadly neutralizing antibodies are secreted by only a handful — about 1 in every 1 million — of the immune system's B cells, Schief said. B cells are the cells that produce antibodies.

"To get the right antibody response, we first need to prime the right B cells," he said.

New technologies for new vaccines

The new approach targets this specific set of B cells with a vaccine compound called eOD-GT8 60mer. In the early safety trial, 48 healthy adult volunteers were given either the vaccine candidate or a placebo shot. The trials didn't directly test whether the vaccine prevented HIV infection but instead looked at whether the vaccine was safe and whether the participants who received the shot produced more broadly neutralizing antibodies than the comparison group who received a placebo.

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

The results, presented Feb. 3 at the International AIDS Society HIV Research for Prevention virtual conference, showed that the desired antibodies were found in 97% of the participants who received the vaccine.

There is a long road ahead for a potential new HIV vaccine, including follow-up trials to test the effectiveness and safety in large groups of people. The researchers hope that partnering with Moderna to use mRNA technology will help them piggyback on the safety and efficacy success seen in the company's COVID-19 vaccines, thereby speeding the process.

Originally published on Live Science.

livescience.com, 7 April 2021

https://www.livescience.com

The dinosaur-killing asteroid impact radically altered Earth's tropical forests

2021-04-01

"The forests that we have today are really the by-product of what happened 66 million years ago."

The day before a giant asteroid hit Earth 66 million years ago, a very different kind of rainforest thrived in what is now Colombia. Ferns unfurled and flowering shrubs bathed in the sunlight that streamed down through large gaps in the canopy between towering conifers.

Then the bolide hit and everything changed (SN: 6/1/20). That impact not only set off a massive extinction event that wiped out more than 75 percent of life on Earth, but it also redefined Earth's tropical rainforests, transforming them from sun-dappled, open-canopied forests into the dark, dense, lush, dripping forests of today's Amazon, researchers report April 2 in Science.

The researchers analyzed tens of thousands of fossils of pollen, spores and leaves, collected from 39 sites across Colombia, that were dated to between 70 million and 56 million years ago. The team then assessed overall forest plant diversity, dominant species and insect-plant interactions, and tracked how these factors shifted. Plant diversity declined by 45 percent in the immediate aftermath of the asteroid strike, the researchers found, and it took 6 million years before the rich diversity of the tropical rainforest rebounded. Even then, the forests were never the same.

"A single historical accident changed the ecological and evolutionary trajectory of tropical rainforests," says Carlos Jaramillo, a

paleopalynologist — someone who studies ancient pollen — at the Smithsonian Tropical Research Institute in Panama City. "The forests that we have today are really the by-product of what happened 66 million years ago."

Bottom of Form

Just before the extinction event, tropical forests were a roughly 50-50 mix of angiosperms, or flowering trees and shrubs, and of other plant species such as conifers and ferns. "The competition for light was not that intense," Jaramillo says. Afterward, ferns and conifers largely vanished, and angiosperms took over to make up about 90 percent of the plant species in the forest.

The reasons why aren't wholly clear. The region's climate at the end of the Cretaceous Period 66 million years ago was similar to how it is today: hot and humid. But other factors were likely at work. Huge plant-eating sauropods, the long-necked dinosaurs, would have helped maintain the open gaps, letting light in, Jaramillo says (SN: 11/17/20). Once the asteroid hit, those dinosaurs were out of the picture. Extinction of certain plant families due to the impact also may have played a role, he says.

A third likely factor was a shift in the chemical composition of the forest soil. Frequent rainfall during the warm, wet Cretaceous leached the soils of many nutrients, which would have favored gymnosperms like conifers, says Jaramillo. "The gymnosperms had this amazing ability to grow with very little food, and could outcompete the angiosperms."

Ashfall fluttering to the ground in the wake of the asteroid impact may have added phosphorus to the soils, effectively fertilizing them, the team suggests. With more food available, angiosperms readily outcompeted the gymnosperms, swiftly growing skyward and blocking out the sunlight.

This thick, closed canopy appeared soon after the impact, but overall forest diversity took much longer to recover, as new species began to evolve to occupy new ecological niches. This was also true of the many insect species that had once feasted on the plants, the researchers found. Leaf fossils bear traces of the different types of interactions between herbivorous insects and plants, from creatures that strip leaves to their skeletons to those that drill careful holes through them.

"Generalist" insects and other plant-munching groups that can make do with many different types of plants for food "seemed to squeak through largely unaffected," says coauthor Conrad Labandeira, a paleoecologist

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

at the Smithsonian National Museum of Natural History in Washington, D.C. (SN: 1/25/17). "The specialist interactions that got really creamed were things like leaf miners and piercers and suckers," which are more dependent on particular plant types, Labandeira says.

The recovery path holds a valuable lesson for the long-lasting impact of modern human activities such as deforestation, Jaramillo says (SN: 9/4/20). "Generating new diversity takes geological time," he says. "It's not just about planting trees."

This is the first comprehensive picture of what happened in tropical ecosystems right after the extinction event, says paleoecologist Elena Stiles of the University of Washington in Seattle, who was not connected with the study. Most previous work on the chunks of time immediately before and after the extinction event — the very end of the Cretaceous and the start of the Paleogene Period — comes from North America, or from much farther south, such as in Patagonia, Stiles says (SN: 4/2/19). "In the tropics, there is no place where we have the boundary [between periods] preserved, [and] we have the limitation of a very fragmentary fossil record."

Also striking, Stiles says, is the possibility that this finding may help answer a longstanding question about South America's astonishing biodiversity. "For a long time, people have wondered where all of this diversity comes from," she says. Researchers have speculated, for example, that the continent's climate or its long isolation from other continents may be responsible. "So it's really interesting that this mass extinction event could have been one of the mechanisms that shaped it to be this unique region," she says.

sciencenews.org, 1 April 2021

https://www.sciencenews.org

Academia is often a family business. That's a barrier for increasing diversity

2021-04-01

When Jessica Flake started her Ph.D. at the University of Connecticut, she hadn't yet figured out that published papers were the currency of academia. Flake, who describes herself as growing up in poverty and was the first in her family to attend college, let alone pursue a Ph.D., found herself navigating an increasingly foreign landscape as she pursued her academic career. "You just don't know how it works," says Flake, who is now

Compared with the wider population of their Ph.D.-holding peers, tenure-track faculty are also nearly twice as likely to have Ph.D.-holding parents.

an assistant professor of psychology at McGill University, and "it gets worse the higher up you go."

A new study quantifies how underrepresented people like Flake are in academia, at least in the United States, finding that tenure-track faculty come from homes wealthier than the average population and are 25 times more likely than the general population to have a parent with a Ph.D. Compared with the wider population of their Ph.D.-holding peers, tenure-track faculty are also nearly twice as likely to have Ph.D.-holding parents. That's based on a survey of more than 7000 U.S.-based tenure-track faculty across eight STEM, social science, and humanities disciplines, reported last week in a preprint posted to SocArXiv. The findings suggest that academia is still accessible largely to people from privileged—and academic—families, highlighting a barrier that intersects with race to limit the diversity of the academy, says lead author Allison Morgan, a University of Colorado (CU), Boulder, Ph.D. student who researches diversity in science. Because Black and Hispanic scholars, among other groups, are underrepresented among current Ph.D. holders, generational effects could impede efforts to diversify academia for many years to come, Morgan adds.

The work offers evidence to support the intuitions of many researchers, says Stephen Thomas, director of the Maryland Center for Health Equity at the University of Maryland, College Park. But it does not address what he considers a more crucial question: "What are we going to do about it?"

It's the responsibility of academic institutions to use results like these to inform interventions that will help people from every background thrive in academia, says Sherilynn Black, associate vice provost for faculty advancement at Duke University. "It's really important not to look at this data and say, 'I didn't have a parent with an advanced degree—maybe that means academia is not for me,'" says Black, a neuroscientist whose research focuses on race, diversity, and academia. And it's crucial to consider economic background as just one part of a constellation of experiences that researchers bring with them into the workplace, she adds. Kim Weeden, a sociologist at Cornell University, also points to a limitation to the study's socioeconomic analysis: The authors used ZIP codes to estimate childhood household income, which introduces messiness, she says.

The study's focus on socioeconomic status "might offer a dangerous suggestion that public policies should focus only on fixing economic issues to address academic (and social) inequalities," writes Gustavo

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

Silva, a biologist at Duke University, in an email to Science Careers. "As an Afro-Brazilian man in an elite American institution, the color of my skin and the texture of my hair are what have defined major parts of my lived experience and professional relationships. I sincerely doubt that [my parents] holding these degrees or having a higher income would have changed most of my experiences."

But the results do invite questions about why these dynamics are at play, Black says. "Why are certain groups more likely to have parents with advanced degrees? Which historical and societal factors led to this outcome? What is it about having a parent who has an advanced degree that leads to this difference?" She points to the intersection of myriad factors, including academia's "hidden curriculum," that could make it easier for people from academic families to navigate the otherwise opaque processes of funding, publishing, professional advancement, and more. Having a parent who has modeled the career path and can offer advice on the faculty job market, setting up a research group, and applying for grants can "make the invisible become visible," Black says, and also make it easier for researchers to believe that they can succeed. Academics who had the example of an academic parent "may feel less uncertainty about if they belong or can succeed in academia."

Thomas also points to the hidden curriculum and the ease that comes with lifelong enculturation. Many brilliant young Black researchers have told him that they find themselves in unfamiliar and intimidating environments, but fear showing gaps in their knowledge because of the high expectations they face, he says. There is also evidence that Black scientists are more likely to study topics influenced by experiences of discrimination or poverty—such as health disparities—and that these research topics are less likely to win funding from the National Institutes of Health, hampering career progress.

The finding of intergenerational inheritance echoes similar patterns across other careers, including doctors, lawyers, clergy, and CEOs, Weeden says, and the research doesn't address whether academia has a higher or lower level of inheritance than other professions. She also notes that excluding non–tenure-track faculty—who make up 75% of U.S. faculty—risks overestimating the gap between faculty and the students they teach.

But the point of the research is not to claim that academia is an outlier, says senior author Aaron Clauset, a computer scientist at CU Boulder. Rather, it's to get the "lay of the land" by describing a facet of academia's diversity problem, as well as to open up new research questions exploring

why economic status and parental education are correlated with academic success, or how interventions might help to close the gap.

The opportunity to build support networks across university departments with other people from similar backgrounds could be one such intervention, Flake suggests. And universities in areas with high costs of living sometimes offer financial support such as competitive loans—similar supports could also be offered based on financial need regardless of the area's cost of living, she suggests, for faculty who don't have a family financial safety net.

But even with targeted interventions like these in place, says Black, "structural racism will still exist, and historical inequities will still exist." Without a focus on the roots of these inequities, she says, interventions will only ever be "like putting a Band-Aid over a bullet wound."

sciencemag.org, 1 April 2021

https://www.sciencemag.org

These viruses are the most likely to trigger the next pandemic, according to scientists

2021-04-07

The novel coronavirus SARS-CoV-2 is the latest pathogen to "spill over" from animals to people, but hundreds of thousands of other viruses lurking in animals could pose a similar threat. Now, a new online tool ranks viruses by their potential to hop from animals to people and cause pandemics.

The tool, called SpillOver, essentially creates a "watch list" of newly discovered animal viruses that pose the greatest threat to human health. The researchers hope their open-access tool can be used by other scientists, policymakers and public health officials to prioritize viruses for further study, surveillance and risk-reducing activities, such as possibly developing vaccines or therapeutics before a disease spills over.

"SARS-CoV-2 is just one example of many thousands of viruses out there that have the potential to spill over from animals to humans," Zoë Grange, who led the development of SpillOver as a postdoctoral researcher with the One Health Institute at the University of California, Davis (UC Davis), said in a statement. "We need to not only identify, but also prioritize, viral threats with the greatest spillover risk before another devastating pandemic happens."

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

Now, a new online tool ranks viruses by their potential to hop from animals to people and cause pandemics.

Spillover risk

Some 250 viruses are known to be "zoonotic," meaning they have already spilled over from animals to people, and an estimated 500,000-plus viruses have spillover potential, the researchers wrote in a paper about the SpillOver tool, published Monday (April 5) in the journal Proceedings of the National Academy of Sciences. But each virus is not equally likely to make the jump from animals to people. So the researchers created a "credit-like" score for viruses as a way of assessing and comparing their risks.

To come up with the score, the tool considers 32 risk factors associated with the virus and its host, such as how many animal species the virus infects and how often humans interact with wild animals in the areas where the virus has been detected.

Then, the researchers used the tool to rank 887 wildlife viruses based on their spillover risk. (Most of the viruses included in the rankings are newly discovered, but some are already known to be zoonotic.)

The top 12 viruses on the list were known zoonotic pathogens, with Lassa virus ranking first, SARS-CoV-2 second and Ebola virus third. (The main animal host for the Lassa virus is rats and main host for Ebola virus is believed to be bats. The main animal hosts for SARS-CoV-2 is unknown, but the virus has been found to infect minks, lions and tigers.)

The authors said they expected this result — known zoonoses ranking at the top — and used it to validate the tool.

But given its current wide-reaching threat to human health, why didn't SARS-CoV-2 rank first? The researchers said their tool ranks the potential for future spillover events. Some important information about SARS-CoV-2 remains unknown, such as the number of host species it infects, and it could take the top spot as researchers learn more about it, the authors said.

Among viruses that aren't yet zoonotic, the top-ranking virus was coronavirus 229E (bat strain), which belongs to the same viral family as SARS-CoV-2 and infects bats in Africa, according to information from SpillOver. Another top-ranking virus is coronavirus PREDICT CoV-35, which also belongs to the coronavirus family and infects bats in Africa and Southeast Asia.

The authors noted that SpillOver is a crowdsourcing platform that allows other researchers to contribute data on viruses already included on the list

or to add viruses to the list, and the rankings may change as new data are added.

"This tool is intended to start a global conversation that will allow us to go far beyond how we thought about ranking viruses in the past and allow real-time scientific collaboration to identify new threats early," study co-author Jonna Mazet, a professor at the UC Davis School of Veterinary Medicine, said in the statement. "SpillOver can help advance our understanding of viral health threats and enable us to act to reduce the risk of spillover before pandemics can catch fire."

livescience.org, 7 April 2021

https://www.livescience.com

Extraction of organic chemistry grammar from unsupervised learning of chemical reactions

2021-04-07

Humans use different domain languages to represent, explore, and communicate scientific concepts. During the last few hundred years, chemists compiled the language of chemical synthesis inferring a series of "reaction rules" from knowing how atoms rearrange during a chemical transformation, a process called atom-mapping. Atom-mapping is a laborious experimental task and, when tackled with computational methods, requires continuous annotation of chemical reactions and the extension of logically consistent directives. Here, we demonstrate that Transformer Neural Networks learn atom-mapping information between products and reactants without supervision or human labeling. Using the Transformer attention weights, we build a chemically agnostic, attention-guided reaction mapper and extract coherent chemical grammar from unannotated sets of reactions. Our method shows remarkable performance in terms of accuracy and speed, even for strongly imbalanced and chemically complex reactions with nontrivial atom-mapping. It provides the missing link between data-driven and rule-based approaches for numerous chemical reaction tasks.

advances.sciencemag.org, 7 April 2021

https://www.advances.sciencemag.org

It provides the missing link between data-driven and rule-based approaches for numerous chemical reaction tasks.

CHEMWATCH
Bulletin Board
Gossip
APR. 16, 2021

Mysterious X-rays are flaring out of Uranus

2021-04-06

For the first time, astronomers have detected mysterious X-rays flaring out of Uranus.

How is this happening? According to NASA scientists, Uranus is so massive that it could just be scattering X-rays given off by the sun more than a billion miles away. Or, perhaps the fine rings of dust surrounding Uranus are generating their own radiation through some unknown process. A closer study of Uranus is required to know for sure.

Uranus is cold, windy and made almost entirely of ice and gas. Even though it's enormous (with a diameter about four times Earth's), Uranus is difficult to study in depth. Only one spacecraft — NASA's Voyager 2 — has ever made the perilous journey to the planet, forcing scientists to rely mostly on telescope observations much closer to Earth in order to study the ice giant.

In a new study published March 31 in the journal JGR Space Physics, astronomers looked at some archival observations of Uranus taken by NASA's Chandra X-Ray Observatory, an orbiting telescope that scours the universe for sources of X-ray radiation.

Y SOUND

According to NASA, X-rays are emitted when matter is heated to millions of degrees, like when stars explode or when matter swirls around the edge of a black hole at near light speed. Until recently, X-ray emissions had been detected from every planet in the solar system except Uranus and Neptune. In most cases, these emissions occur when X-rays created by the sun crash into atoms in a planet's atmosphere, scattering the light back into space.

In the new study, researchers looked at Chandra data taken from Uranus in 2002 and 2017, and saw clear evidence of X-ray emissions in both years. Several of these emissions had a brightness consistent with solar X-rays being scattered back outward, the researchers wrote. However, in the 2017 observations, the team detected a possible "flare" of X-rays, where the brightness of emissions around Uranus increased four times from one day to the next.

According to the researchers, "this may be indicative of additional X-ray emission processes at Uranus," besides mere solar scattering.

What mysterious phenomenon could be generating the X-rays from Uranus? One possibility lies in the planet's rings. According to the researchers, the environment around Uranus is rich in charged particles such as protons and electrons; these particles could be colliding into the planet's rings, producing X-rays in the process. (A similar phenomenon has been observed in Saturn's rings, the team wrote.)

It's also possible that the X-rays are the result of some sort of auroral process, in which charged particles from the sun are colliding with Uranus' magnetic-field lines and causing a distinct glow. However, further observations are required to flesh out this hypothesis. For now, the X-ray lights of Uranus remain a mystery.

Originally published on Live Science.

livescience.com, 6 April 2021

https://www.livescience.com

CHEMWATCH
Bulletin Board

Turtles complete seemingly impossible journey thanks to a hidden 'corridor' through the Pacific

2021-04-09

North Pacific loggerhead sea turtles (Caretta caretta) hatch on the shores of Japan and spend much of their time in the open Pacific, but sometimes mysteriously crop up in Mexico, 9,000 miles (14,500 kilometers) away from their original nesting ground.

That incredible journey requires them to pass through potentially deadly, cold waters that should be inhospitable to them, since loggerheads rely on warmth from the surrounding environment to maintain their core body temperatures. Now, scientists have a clue as to how the turtles survive this epic migration.

"This mystery had been around for decades, and nobody had a clue how to explain it," said senior author Larry Crowder, a professor of marine ecology and conservation at Stanford University's Hopkins Marine Station and a senior fellow at the Stanford Woods Institute for the Environment.

Along the North American Pacific coast, seasonal winds from the north periodically sweep down the shoreline, pushing warm surface waters offshore. Cold water from the deep ocean then rises up to replace that warm water, dragging up an abundance of nutrients with it. Tropical animals, including loggerheads, rarely venture into these cold waters from the open Pacific, Crowder said. Charles Darwin even described the region as "impassable" for warm-water-loving critters, he added. PLAY SOUND

But according to the new study, published April 8 in the journal Frontiers in Marine Science, loggerheads may have a fleeting opportunity to reach the Mexican coast during El Niño, a climate cycle that shifts warm water in the western tropical Pacific Ocean eastward along the equator.

"A warm 'door' needs to open for these turtles to get to Mexico," Crowder told Live Science. The study authors refer to this temporary door as a "thermal corridor" — essentially a passageway of warm water. "During El Niño, the turtles get a shot at going across."

This study not only sheds light on a long-standing mystery but could also provide critical information for protecting loggerheads, which are considered "vulnerable" by the International Union for Conservation of Nature (IUCN). Conservation efforts may need to adapt as the turtles react to warming waters, driven by climate change, Crowder said.

Now, scientists have a clue as to how the turtles survive this epic migration.

"With climate change comes increasingly warmer sea surface temperatures and longer periods of warm water events in the Pacific Ocean," said Carolyn Kurle, an associate professor of biological science at the University of California, San Diego, who was not involved in the study.

If the thermal corridor hypothesis is true, more loggerhead juveniles may migrate to the North American coast over time, Kurle told Live Science in an email. This could be beneficial to young turtles, since the ample nutrients in these coastal waters boost the turtles' food supply, she said. "But it would be terrible" if more young turtles accidentally became ensnared in fishing nets along the coast, especially since those turtles would not have the chance to return to Japan and mate, Kurle told Live Science.

A decades-long mystery

Loggerheads can be found all over the world, primarily in subtropical and temperate waters, and are divided into nine subpopulations, including the North Pacific subpopulation, according to the National Oceanic and Atmospheric Administration (NOAA). Scientists first got a clue that North Pacific loggerheads migrate between Mexico and Japan when Adelita, a female turtle, was released from captivity in Baja California in 1996 and immediately made a beeline for East Asia, Crowder said.

Marine biologist Wallace Nichols had attached a satellite-tag to Adelita, so he was able to track her entire journey to Japan, according to PBS. Crowder and his co-authors used similar tracking data for their new study, but they pulled from an enormous dataset of 231 juvenile loggerheads whose migratory patterns had been monitored for 15 years.

About 97% of these loggerheads remained in the open ocean and did not venture toward the North American coast. In fact, when these turtles did near the edge of the coastal ecosystem, they promptly turned around. Dana Briscoe, a postdoctoral researcher in Crowder's lab at the time, found that the timing of the turnaround appeared to be driven by Earth's magnetic field, which the turtles can sense and use to navigate through the ocean. Presumably this ability helps them avoid cold water, Crowder said.

However, Briscoe noticed that not all the turtles turned around at the typical point — six of the 231 turtles just continued on their merry way and swam right into coastal waters, entering an area known as the California Current Large Marine Ecosystem (CCLME). The team looked closer at these six outliers and found that they each made their journey

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

in the spring, and based on data gathered from remote sensors, these wandering turtles "experienced unusually warm conditions," compared with their counterparts.

"And the two that made it closest to Baja experienced the warmest water conditions," Crowder said. Seeing this connection to warm water, the team developed their thermal corridor hypothesis.

But because only six turtles out of 231 — roughly 3% — entered the CCLME, the team needed more data to back up their idea. So they teamed up with Calandra Turner Tomaszewicz, a scientist at the NOAA Southwest Fisheries Science Center, whose group had been studying the bones of turtles that had stranded in Mexico and died on the shore.

Sea turtle bones contain annual growth rings, similar to trees. A new ring grows around the outside of the bone each year, while one ring erodes from the center of the bone. A turtle's humerus bone, a type of leg bone, has about six to eight growth rings at any given time, Crowder said.

These growth rings contain clues about what a turtle ate in a given year, in the form of stable isotopes, which are chemical elements with different numbers of neutrons. Provided a scientist knows when the turtle died, they can use these chemical clues to determine what the turtle ate throughout its life, and therefore, where that turtle was likely located.

"And the stable isotope ratios in open ocean-food, like jellyfishes, is dramatically different than in crabs," which is what a loggerhead would eat in coastal waters, Crowder said. In this way, the team determined when a given turtle made the jump from open to coastal waters. They then looked up water temperatures in that year.

Turner Tomaszewicz and her colleagues analyzed the growth rings of 33 loggerheads in Mexico and found that more than 60% of the turtles entered the region near the shore in a year with warm ocean conditions. Grouping the turtles by year revealed that far more turtles arrived in Mexico in the warm years than cool ones.

"The bone growth layer analyses absolutely strengthened their thermal corridor hypothesis," supporting the idea that these transient passages of warm water help more turtles reach the North American coast, Kurle said.

The hypothesis might also explain why loggerhead turtles from Japan cropped up in San Diego Bay in 2016, an El Niño year, Crowder said. The turtles only rarely show up in southern California, and even then, they don't usually appear in large groups, as they did that year, according to

The San Diego Union-Tribune. The strange event led some scientists to wonder whether, with climate change, loggerheads might come to San Diego more often.

Of course, the thermal corridor hypothesis is still just that — a hypothesis. Ideally, the team would be able to satellite-tag more loggerheads, track their movements and see how many migrate to Mexico in El Niño years, compared with cool La Niña years , Kurle said. However, seeing that so few turtles seem to enter the CCLME, this effort would likely be expensive and impractical, Crowder said. Instead, he said he hopes to conduct an experimental study with a few dozen turtles, where two groups of loggerheads would be released into the open ocean near the CCLME boundary, one in a El Niño year, and one in a La Niña year.

But for now, even with its limited data, the current study "will help those who seek to understand and manage this vulnerable species with one of the longest migrations in the animal kingdom," Kurle told Live Science.

Originally published on Live Science.

livescience.com, 9 April 2021

https://www.livescience.com

People add by default even when subtraction makes more sense

2021-04-07

Picture a bridge made of Legos. One side has three support pieces, the other two. How would you stabilize the bridge?

Most people would add a piece so that there are three supports on each side, a new study suggests. But why not remove a piece so that each side has two supports instead? It turns out that getting people to subtract — whether a Lego block, ingredients in a recipe or words in an essay — requires reminders and rewards, researchers report April 7 in Nature.

This default to addition isn't limited to assembling blocks, cooking and writing. Rather, thinking in pluses instead of minuses could well contribute to modern-day excesses such as cluttered homes, institutional red tape and even an overburdened planet, says behavioral scientist Benjamin Converse of the University of Virginia in Charlottesville. "We're missing an entire class of solutions."

How would you stabilize the bridge?

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

He and his colleagues first observed the behavior when they asked 1,585 study participants to tackle eight puzzles and problems that could be solved by adding or removing some things. For example, one puzzle required shading or erasing squares on a grid to make a pattern symmetric. In another, individuals could add or subtract items on a travel itinerary for the optimal experience. Across all experiments, the vast majority of participants chose addition over subtraction. For instance, out of 94 participants who completed the grid task, 73 added squares, 18 subtracted squares and another three simply reworked the original number of squares.

The researchers hypothesized that most participants defaulted to adding because they failed to even think about subtraction. So, through a series of controlled experiments, the team nudged participants toward the minus sign.

In one experiment, the team offered 197 people wandering around a crowded university quad a dollar to solve a puzzle. Participants viewed a Lego structure in which a figurine was standing atop a platform with a large pillar behind her. Atop that pillar, a single block in one corner supported a flat roof. Researchers asked the participants to stabilize the roof to avoid squashing the figurine. About half the participants were told: "Each piece you add costs 10 cents." Even with that financial penalty, only 40 out of 98 participants thought to remove the destabilizing block and just rest the roof on top of the wide pillar. The researchers gave the remaining participants a more explicit message: "Each piece you add costs 10 cents but removing pieces is free." That cue prompted 60 out of 99 participants to remove the block.

Practice did help participants call to mind that elusive minus sign, the researchers found. A variation on the grid experiment, where subtraction yielded the superior solution, showed that three practice runs leading up to the actual task prompted more participants to subtract than those who solved the task without practice.

"When people try to make something better … they don't think that they can remove or subtract unless they are somehow prompted to do so," says behavioral scientist Gabrielle Adams, also at the University of Virginia.

Conversely, bombarding participants with unrelated information decreased their likelihood of subtracting (SN: 5/24/20). People add even more when they experience information overload, those experiments showed.

On an intuitive level, people recognize that subtraction comes less naturally than addition, the authors say. Hence the adoption of adages, such as "less is more" and Marie Kondo's now infamous mantra to get rid of those things that fail to spark joy.

But curbing our love of excess will take more than nudges and a clear mind, says Hal Arkes, a judgement and decision-making researcher at Ohio State University who was not involved with the study. Organizational and political leaders, especially, abhor cutting the fat. "If you add more people and more dollars, you won't make any enemies, you'll just make friends," Arkes says. "Subtraction has serious downsides."

sciencenews.org, 7 April 2021

https://www.sciencenews.org

A pigment from red cabbage could help turn your favourite foods blue

2021-04-09

It's not that hard to make a natural blue dye. Just take a red cabbage, cut it into pieces, and boil it. What you get is a purple broth that turns bright blue when you add some baking powder.

Children have been doing this for decades, but researchers have struggled to turn this or similar natural blues into a stable and abundant colorant—one that could be used to naturally dye your favorite candies, sodas, or ice creams. Now, a team says it has found a way—and the key lies in the humble cabbage itself.

It's a "significant advance," says Mas Subramanian, a chemist at Oregon State University, Corvallis, who was not involved with the work. In 2009, Subramanian discovered a new blue pigment, though not one to be eaten; it hit shelves this year as an artist's paint. But the art world was looking for a deep blue like Subramanian's, while the food world is chasing a natural source of a lighter cyan blue to color ice cream or candies, he says.

Cyan is also needed to create other colors, especially green, says Rebecca Robbins, senior principal scientist at Mars Wrigley, who was involved in the new work. "The color blue is used in more products than consumers realize."

The food industry mostly relies on two synthetic dyes to create blue candies, cereals, and drinks: "brilliant blue," also known as E131, and indigotine, or E132. Although these work well, "There has just been a really large push by consumers to get rid of synthetic ingredients in their food," says Pamela Denish, a biophysicist at the University of California, Davis.

"The color blue is used in more products than consumers realize."

Replacing current dyes with natural colorants has proved difficult, however. That's in part because there are few natural blues in nature. Pigments called anthocyanins, including those in red cabbage, can produce a blue color. But they're not very stable, and they have a lot of purple undertones, Denish says. The latter becomes a problem when blending it with yellow to create green. "Purple plus yellow equals brown, so you're not going to get a very vibrant green," she says. That's also a problem of spirulina blue, a crude extract derived from spirulina algae that has been approved in the United States as a natural dye for some foods.

The bar for any new blue is high, says Erick Leite Bastos, a chemist at the University of São Paulo, São Paulo, who is working on developing a blue dye derived from beetroot. On top of being natural, the perfect blue dye must be easy to use, safe to eat, cheap to produce—and "have a hue that people like," he says.

In the new study, Denish and colleagues tried to get anthocyanins to hold onto their true blue color. The pigments in red cabbage are a mix of different molecules, and the researchers concentrated on a particularly promising one, which they call P2. Mixing this molecule with aluminum ions led to complexes with three of the P2 molecules arranged around one aluminum ion like spokes on a wheel. The complex was a stronger, more stable blue.

That only solved part of the problem, however. Only about 5% of the anthocyanins in red cabbage are P2, making the process terribly inefficient. Searching through databases of enzymes, the scientists hit on one—from bacteria—that could help convert some of the other anthocyanins into P2. And mutating the enzyme increased its efficiency. Now, about half of the anthocyanins in red cabbage could be turned into the blue P2 molecule, the team reports this week in Science Advances. "All of that is cleaned out of the final product," Denish says. "So there's not actually any bacteria or any enzymes in the pigment itself."

The new candidate blue still faces many hurdles. For one, producing it takes a lot of effort: With the mutated enzyme, the researchers can extract only about 75 milligrams of blue from 100 grams of red cabbage. And, Bastos notes, "It is yet to be determined whether these metal complexes are safe for human consumption."

Copyright Chemwatch 2021 ©

Still, the mere chance of seeing her work make it out into the real world excites Denish, who is just finishing her Ph.D. Some of her friends are expecting more tangible returns, however. "I have a lot of friends who think that I'm going to be able to get them free candy," Denish says. "I don't think that's how this works."

sciencemag.org, 9 April 2021

https://www.sciencemag.org

Seed monopolies: Who controls the world's food supply?

2021-04-08

For thousands of years of human agriculture, the intrinsic nature of a seed — the capacity to reproduce itself — prevented it from being easily commodified. Grown and resown by farmers, seeds were freely exchanged and shared.

All that changed in the 1990s when laws were introduced to protect new bioengineered crops. Today, four corporations — Bayer, Corteva, ChemChina and Limagrain — control more than 50% of the world's seeds. These staggering monopolies dominate the global food supply.

"Seeds are ultimately what feed us and the animals we eat," Jack Kloppenburg, a rural sociologist and professor at the University of Wisconsin-Madison, said. "Control over seeds is, in many ways, control over the food supply. The question of who produces new plant varieties is absolutely critical for the future of all of us."

Not only are the channels through which seeds can be exchanged and distributed narrowing: Seeds themselves are becoming less diverse. According to the UN Food and Agriculture Organization, 75% of the world's crop varieties disappeared between 1900 and 2000.

A huge wealth of locally adapted crops is being replaced by standardized varieties. And experts warn that could have grave consequences for food security — especially as the planet heats up.

Regulating plants and outlawing tradition

Major producers of genetically modified and bioengineered seeds, like Bayer and Corteva, strictly limit how farmers can use the varieties they sell. Usually, buyers must sign agreements that prohibit them from saving seeds from their crops to exchange or resow the following year.

"Control over seeds is, in many ways, control over the food supply.["]

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

Most countries only allow patents — exclusive ownership rights that were not originally created with living organisms in mind — on genetically modified seeds. But other plant varieties can also be strictly controlled by another type of intellectual property legislation called Plant Variety Protection.

The World Trade Organization requires member states — virtually all the world's nations — to have some form of legislation protecting plant varieties. More and more of them are fulfilling this requirement by signing up to the International Union for the Protection of New Varieties of Plants (UPOV), which places limits on the production, sale and exchange of seeds.

UPOV — and agribusinesses such as Bayer — say the restrictions they impose encourage innovation by allowing breeders a temporary monopoly to profit from the new plant varieties they develop without facing competition.

"It means, then, that they're able to control the way in which that variety is commercialized, and they can get a return on the investment they make — because it takes anything up to 10 or 15 years to develop a new variety," said Peter Button, vice secretary general of UPOV.

But to meet UPOV criteria, commercial seeds must be genetically distinct, uniform and stable. Most ordinary seeds are none of these things.

The varieties that ordinary farmers develop, and those handed down through generations, are genetically diverse and continually evolving. Unable to meet these criteria, farmers not only lack intellectual property rights to the plant varieties they breed themselves: In many countries their varieties can't be certified as seeds at all.

In addition to Plant Variety Protection, seed marketing laws in many countries forbid the sale — and often, even the sharing — of seeds that haven't been certified to meet standards such as a high commercial yield under industrial farming conditions.

Often, the only legal option is to buy seeds from corporate agribusinesses. And that means more and more of the world's food relies on less and less genetic diversity.

Diversity for climate resilience

Karine Peschard, a researcher into biotechnology, food and seed sovereignty at the Graduate Institute of International and Development Studies, Geneva, says this is problematic in a warming world.

Changing climatic conditions mean farmers' carefully attuned agricultural systems are thrown out of whack. Particular crops need particular conditions, and as temperatures and rainfall shift, so, too, do the areas in which a plant can thrive.

By planting a range of different crops, each with its own genetic diversity and potential for change, the plants themselves can adapt, and if one crop fails, farmers don't necessarily lose their whole harvest.

"The more uniform our genetic pool is, the more vulnerable we are to all sorts of environmental stresses, and we know that with climate change there will be more of these stresses," Peschard said.

'Neocolonial agriculture'

There is no legal obligation to join the UPOV. But countries including the United States, Canada, Switzerland, Japan, as well as the member states of the European Union, are among the nations using bilateral and regional trade agreements to pressure countries in the Global South, such as Zimbabwe and India, to join.

Critics say imposing uniform rules on a global scale ultimately means forcing the industrial farming that dominates Europe and the US onto parts of the world where food is still largely produced by smaller-scale, more sustainable farms.

"We're looking at this as neocolonialism destroying our livelihoods and our environment," said Mariam Mayet, director of the African Center for Biodiversity in South Africa.

Switching to standardized seeds changes whole agricultural systems. The big four agribusinesses also produce fertilizers and pesticides that farmers must buy to ensure their yield. Adopting these systems dictates the way fields are laid out, what other species can survive and the nutrient composition of the soil.

'Let the people feed themselves'

Mayet is calling for exceptions to seed legislation to allow farmers the autonomy to preserve the Indigenous agriculture that is "the bedrock to ensure ecological integrity, sustainability of nature, biodiversity, landscapes and ecosystems." She's not alone.

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

Around the world, food sovereignty movements such as the transnational La Via Campesina, the Alliance for Sustainable and Holistic Agriculture in India, the Third World Network in Southeast Asia and Let's Liberate Diversity! in Europe, are advocating for seed networks that allow farmers and communities to bypass the corporate agribusiness giants and manage seeds on their own terms.

For the last six years, rural sociologist Jack Kloppenburg has been packaging seeds and sending them to farmers through the Open Source Seed Initiative (OSSI).

Drawing inspiration from open-source software — computer code available for anyone to use, distribute, and modify, as long as users allow others the same freedoms — open-source seed varieties are freely available and widely exchanged.

Instead of a license, their use is subject to a pledge.

Each packet of OSSI seeds bears a statement that reads: "By opening this packet, you pledge that you will not restrict others' use of these seeds and their derivatives by patents, licenses, or any other means. You pledge that if you transfer these seeds or their derivatives you will acknowledge the source of these seeds and accompany your transfer with this pledge."

Kloppenburg admits that the OSSI model isn't perfect: Because the seeds it distributes are not legally protected, they're vulnerable to appropriation by commercial interests. But he believes that as a way of sharing for the common good, it's a concept that could be adapted to local needs.

Industrialized agriculture — which maximizes yield at the expense of biodiversity and ecology — is often justified by the argument that we have to feed the world. For Kloppenburg, this is the wrong way to look at things. "People need to feed themselves — they need to be allowed to feed themselves," he says.

dw.com, 8 April 2021

https://www.dw.com

Here's a crash course in just what mRNA is and the important job it does.

What is mRNA? The messenger molecule that's been in every living cell for billions of years is the key ingredient in some COVID-19 vaccines

2021-04-09

One surprising star of the coronavirus pandemic response has been the molecule called mRNA. It's the key ingredient in the Pfizer and Moderna COVID-19 vaccines. But mRNA itself is not a new invention from the lab. It evolved billions of years ago and is naturally found in every cell in your body. Scientists think RNA originated in the earliest life forms, even before DNA existed.

Here's a crash course in just what mRNA is and the important job it does.

Meet the genetic middleman

You probably know about DNA. It's the molecule that contains all of your genes spelled out in a four-letter code – A, C, G and T.

DNA is found inside the cells of every living thing. It's protected in a part of the cell called the nucleus. The genes are the details in the DNA blueprint for all the physical characteristics that make you uniquely you.

But the information from your genes has to get from the DNA in the nucleus out to the main part of the cell – the cytoplasm – where proteins are assembled. Cells rely on proteins to carry out the many processes necessary for the body to function. That's where messenger RNA, or mRNA for short, comes in.

Sections of the DNA code are transcribed into shortened messages that are instructions for making proteins. These messages – the mRNA – are transported out to the main part of the cell. Once the mRNA arrives, the cell can produce particular proteins from these instructions.

The structure of RNA is similar to DNA but has some important differences. RNA is a single strand of code letters (nucleotides), while DNA is double-stranded. The RNA code contains a U instead of a T – uracil instead of thymine. Both RNA and DNA structures have a backbone made of sugar and phosphate molecules, but RNA's sugar is ribose and DNA's is deoxyribose. DNA's sugar contains one less oxygen atom and this difference is reflected in their names: DNA is the nickname for deoxyribonucleic acid, RNA is ribonucleic acid.

Identical copies of DNA reside in every single cell of an organism, from a lung cell to a muscle cell to a neuron. RNA is produced as needed in

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

response to the dynamic cellular environment and the immediate needs of the body. It's mRNA's job to help fire up the cellular machinery to build the proteins, as encoded by the DNA, that are appropriate for that time and place.

The process that converts DNA to mRNA to protein is the foundation for how the cell functions.

Programmed to self-destruct

As the intermediary messenger, mRNA is an important safety mechanism in the cell. It prevents invaders from hijacking the cellular machinery to produce foreign proteins because any RNA outside of the cell is instantaneously targeted for destruction by enzymes called RNases. When these enzymes recognize the structure and the U in the RNA code, they erase the message, protecting the cell from false instructions.

The mRNA also gives the cell a way to control the rate of protein production – turning the blueprints "on" or "off" as needed. No cell wants to produce every protein described in your whole genome all at once.

Messenger RNA instructions are timed to self-destruct, like a disappearing text or snapchat message. Structural features of the mRNA – the U in the code, its single-stranded shape, ribose sugar and its specific sequence – ensure that the mRNA has a short half-life. These features combine to enable the message to be "read," translated into proteins, and then quickly destroyed – within minutes for certain proteins that need to be tightly controlled, or up to a few hours for others.

Once the instructions vanish, protein production stops until the protein factories receive a new message.

Harnessing mRNA for vaccination

All of mRNA's characteristics made it of great interest to vaccine developers. The goal of a vaccine is to get your immune system to react to a harmless version or part of a germ so when you encounter the real thing you're ready to fight it off. Researchers found a way to introduce and protect an mRNA message with the code for a portion of the spike protein on the SARS-CoV-2 virus's surface.

The vaccine provides just enough mRNA to make just enough of the spike protein for a person's immune system to generate antibodies that protect them if they are later exposed to the virus. The mRNA in the vaccine is

soon destroyed by the cell – just as any other mRNA would be. The mRNA cannot get into the cell nucleus and it cannot affect a person's DNA.

Although these are new vaccines, the underlying technology was initially developed many years ago and improved incrementally over time. As a result, the vaccines have been well tested for safety. The success of these mRNA vaccines against COVID-19, in terms of safety and efficacy, predicts a bright future for new vaccine therapies that can be quickly tailored to new, emerging threats. Early-stage clinical trials using mRNA vaccines have already been conducted for influenza, Zika, rabies, and cytomegalovirus. Certainly, creative scientists are already considering and developing therapies for other diseases or disorders that might benefit from an approach similar to that used for the vaccines against COVID-19.

theconversation.com, date

https://www.theconversation.com

These endangered monkeys kept getting hit by cars. Scientists had a clever solution.

2021-04-10

Endangered primates that are frequently killed by cars while trying to cross the road in a national park in Zanzibar have been given a lifeline after scientists put in speed bumps to slow down traffic.

Zanzibar red colobuses (Piliocolobus kirkii) are small primates with a white coat, red back and black face. They are currently listed as an endangered species, with fewer than 6,000 mature individuals left in the wild, according to the International Union for Conservation of Nature (IUCN) Red List of endangered species. The species is endemic to Unguja — the largest island in the Zanzibar archipelago in the Indian Ocean — and most individuals now live within Jozani-Chwaka Bay National Park.

However, despite being a protected species within a safeguarded area, these small primates are still under threat from humans, scientists report in a new study. Red colobuses are frequently hit by cars as they try to cross the main road through the park. In response, a group of scientists from Bangor University, the Wildlife Conservation Society (WCS) and national parks in Zanzibar installed four speed bumps along the road.

"After the road at Jozani was surfaced but before the speedbumps were installed, a colobus was reported to have been killed every two to three weeks, resulting in perhaps about 12% to 17% annual mortality," lead

Red colobuses are frequently hit by cars as they try to cross the main road through the park.

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

author Harry Olgun, a doctoral student at Bangor University in the U.K., said in a statement.

Since they installed the speed bumps, the rate of collisions between cars and red colobuses has halved, according to the researchers. "The recent data show that speed bumps have made a huge difference for the safety of the colobus," Olgun said in the statement.

However, collisions with cars still remain a big risk.

"Cars are not selective in the animals they kill," co-author Alexander Georgiev, a primatologist at Bangor University and director of the Zanzibar Red Colobus Project, said in the statement. In the wild, predators target the youngest and oldest individuals in the population, but cars are "equally likely to kill reproductively active young adults," which could stop the population from rebounding, Georgiev said.

However, the researchers still believe there is hope for these adorable primates.

"As tourism grows in Zanzibar and habitat continues to shrink, using science to quantify and solve conservation problems has never been so important," co-author Tim Davenport, director of species conservation and science in Africa at the Wildlife Conservation Society, said in the statement. "Understanding the impact of vehicles on wildlife within a park, and implementing practical solutions is exactly what we as conservationists should be doing."

The study was published online March 16 in the journal Oryx.

Originally published on Live Science.

livescience.com, 10 April 2021

https://www.livescience.com

Gallium boils at 4,044 degrees F, but will also melt in your hand

2021-01-11

Gallium is a rare, silvery white element that can pull off one of the coolest parlor tricks on the periodic table. At room temperature, gallium is a shiny metallic solid that resembles pure aluminum. But hold it in your hands for a few minutes and this solid hunk of metal starts to melt.

But hold it in your hands for a few minutes and this solid hunk of metal starts to melt.

Yup, the melting point of gallium is just 85.6 degrees F (29.8 degrees C), which means that it melts into a mirror-like puddle in your hot little hand. In its liquid form, gallium looks a lot like mercury, but gallium isn't toxic like mercury so it's safer to handle (although it can stain your skin).

But gallium is so much more than fodder for melt-in-your-hand YouTube videos. It's also a key ingredient in LED lights and the go-to semiconductor material for the powerful microchips in your smartphone. The only thing stopping gallium from taking over the electronics world is that it's very rare and very expensive compared to silicon.

Mendeleev Predicted the Existence of Gallium

Pure gallium doesn't exist in its shiny elemental form in nature. It needs to be extracted from minerals like bauxite through a multi-step chemical process. According to the U.S. Geological Survey, the abundance of gallium in Earth's crust is a measly 19 parts per million (silicon, by comparison, is 282,000 parts per million). The first person to isolate and recognize gallium as a new element was the French chemist Paul-Emile Lecoq de Boisbaudran in 1875. He named it gallium after the Latin name for France, "Gallia."

But four years before Boisbaudran's discovery, the famed Russian chemist Dmitri Mendeleev predicted gallium's existence. Mendeleev, known as the "father of the periodic table," saw that there was a gap in the table after aluminum, so he posited that a missing element he called "eka-aluminum" would share many of the properties of aluminum, but with a different atomic structure.

Mendeleev was right, but he couldn't have predicted how gallium's unusual qualities — somewhere between a metal and a nonmetal — would make it ideal for modern electronics.

An Element With an Identity Crisis

Here's another cool and somewhat bizarre fact about gallium: While it melts at just 85.6 degrees F (29.8 degrees C), it doesn't boil until a scorching 3,999 degrees F (2,204 degrees C). That earns gallium the award for maintaining the longest liquid phase of any element. But why does that happen?

"Gallium is confused," says Daniel Mindiola, a chemistry professor at the University of Pennsylvania who we reached through the American Chemical Society. "It melts at a low temperature, which is consistent with a light element, but it boils at a very high temperature, which is consistent

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

with a very heavy element. Gallium doesn't know if it wants to be a metal or a nonmetal."

Gallium's dual personality stems from where it sits on the periodic table among two groups called the "metalloids" and the "post-transition metals." Gallium is next in line after aluminum, but its atoms are far more "independent" than its shiny foil (get it?) and aluminum is more "electropositive," says Mindiola, a trait of true metals.

Like silicon, gallium is a good conductor of electricity, but not a great one. That's what makes both of these metalloids prime candidates for semiconductors, where the flow of electricity needs to be controlled.

"Gallium is actually the ideal semiconducting material, even better than silicon," says Mindiola. "The problem is it's rare, so it's expensive."

Using current manufacturing processes, a wafer of gallium arsenide, the most popular gallium-based semiconductor material, is roughly 1,000 times more expensive than a silicon wafer.

There's Gallium in Your Gadgets

Even though gallium is much more expensive than silicon, it's become a popular semiconductor material in the latest generations of smartphones. Smartphones communicate with cellular data networks using radio frequency (RF) chips, and RF chips made with gallium arsenide give off less heat than silicon and can operate at higher frequency bands, a requirement for 5G networks. A little more than 70 percent of all the gallium consumed in the U.S. is used to make RF chips and other types of integrated circuits, according to the USGS.

But one of the coolest applications of gallium is in light-emitting diodes (LEDs), which are now used in everything from computer displays to traffic lights to luxury car headlights. LEDs are so popular because they are super-efficient, converting electricity directly into light. The first visible-light LEDs were invented in the early 1960s when researchers at General Electric discovered the unique properties of diodes made with various gallium alloys (combinations of gallium, arsenic, nitrogen, phosphorus and other elements).

In a diode, electrons move through two layers of semiconductor material, one with a positive charge and the other with a negative. As free electrons from the negative side fill "holes" in the positive side, they emit a photon of light as a byproduct. Scientists have discovered that different gallium alloys emit photons of different visible light frequencies. Gallium arsenide

and gallium phosphide produce red, orange and yellow light, while gallium nitride produces blue light.

"Just apply a current to an LED and it lights up like a Christmas tree," says Mindiola.

Not only do LEDs produce light when connected to electricity, but the process can be reversed. The special diodes inside of solar cells are also made of gallium-based semiconductors. They take incoming light and separate it into free electrons and "holes," generating voltage that can be saved in a battery as electricity.

Other Nifty Uses of Gallium

"Medicine is beginning to use gallium, too, for detecting and treating certain types of cancers," says Mindiola. "Gallium-67 is attracted to cells that replicate faster than normal, which is what happens in a tumor."

Gallium-67 is a radioactive isotope of gallium that emits non-toxic gamma rays. Radiologists can scan a patient's whole body for tumors or inflammation from an infection by injecting gallium-67 into their bloodstream. Since gallium-67 binds to clumps of fast-growing cells, those potential trouble spots will show up on a PET scan or any other scan that's sensitive to gamma rays. Gallium nitrate has also shown effectiveness in shrinking and killing certain types of tumors, not just detecting them.

The aerospace industry has been hot on gallium for decades. All the high-end solar panels that power satellites and long-range spacecraft are made with gallium arsenide, including the critical solar panels on the Mars Exploration Rovers. At peak performance, the gallium-based solar cells on the Mars rovers could produce 900 watt-hours of energy per Martian day.

science.howstuffworks.com, 11 January 2021

https://www.science.howstuffworks.com

A spike in Arctic lightning strikes may be linked to Climate Change

2021-04-06

Climate change may be sparking more lightning in the Arctic.

Data from a worldwide network of lightning sensors suggest that the frequency of lightning strikes in the region has shot up over the last decade, researchers report online March 22 in Geophysical Research

That may be because the Arctic, historically too cold to fuel many thunderstorms, is heating up twice as fast as the rest of the world.

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

Letters. That may be because the Arctic, historically too cold to fuel many thunderstorms, is heating up twice as fast as the rest of the world (SN: 8/2/19).

The new analysis used observations from the World Wide Lightning Location Network, which has sensors across the globe that detect radio waves emitted by lightning bolts. Researchers tallied lightning strikes in the Arctic during the stormiest months of June, July and August from 2010 to 2020. The team counted everywhere above 65° N latitude, which cuts through the middle of Alaska, as the Arctic.

The number of lightning strikes that the detection network precisely located in the Arctic spiked from about 35,000 in 2010 to about 240,000 in 2020. Part of that uptick in detections may have resulted from the sensor network expanding from about 40 stations to more than 60 stations over the decade.

And just looking at the 2010 and 2020 values alone may overstate the increase in lightning, because "there's such variability, year to year," and 2020 was a particularly stormy year, says Robert Holzworth, an atmospheric and space scientist at the University of Washington in Seattle. In estimating the increase in average annual lightning strikes, "I would argue that we have really good evidence that the number of strokes in the Arctic has increased by, say, 300 percent," Holzworth says.

That increase happened while global summertime temperatures rose from about 0.7 degrees Celsius above the 20th century average to about 0.9 degrees C above — hinting that global warming may create more favorable conditions for lightning in the Arctic.

It makes sense that a warmer climate could generate more lightning in historically colder climes, says Sander Veraverbeke, an earth systems scientist at VU University Amsterdam who was not involved in the work. If it does, that could potentially ignite more wildfires (SN: 4/11/19). But the apparent trend in Arctic lightning strikes should be taken with a grain of salt because it covers such a short period of time and the detection network includes few observing stations at high latitudes, Veraverbeke says. "We need more stations in the high north to really accurately monitor the lightning there."

sciencenews.org, 6 April 2021

https://www.sciencenews.org

A closer study of Uranus is required to know for sure.

Mysterious X-rayd are flaring out of Uranus

2021-04-06

For the first time, astronomers have detected mysterious X-rays flaring out of Uranus.

How is this happening? According to NASA scientists, Uranus is so massive that it could just be scattering X-rays given off by the sun more than a billion miles away. Or, perhaps the fine rings of dust surrounding Uranus are generating their own radiation through some unknown process. A closer study of Uranus is required to know for sure.

Uranus is cold, windy and made almost entirely of ice and gas. Even though it's enormous (with a diameter about four times Earth's), Uranus is difficult to study in depth. Only one spacecraft — NASA's Voyager 2 — has ever made the perilous journey to the planet, forcing scientists to rely mostly on telescope observations much closer to Earth in order to study the ice giant.

In a new study published March 31 in the journal JGR Space Physics, astronomers looked at some archival observations of Uranus taken by NASA's Chandra X-Ray Observatory, an orbiting telescope that scours the universe for sources of X-ray radiation.

PLAY SOUND

According to NASA, X-rays are emitted when matter is heated to millions of degrees, like when stars explode or when matter swirls around the edge of a black hole at near light speed. Until recently, X-ray emissions had been detected from every planet in the solar system except Uranus and Neptune. In most cases, these emissions occur when X-rays created by the sun crash into atoms in a planet's atmosphere, scattering the light back into space.

In the new study, researchers looked at Chandra data taken from Uranus in 2002 and 2017, and saw clear evidence of X-ray emissions in both years. Several of these emissions had a brightness consistent with solar X-rays being scattered back outward, the researchers wrote. However, in the 2017 observations, the team detected a possible "flare" of X-rays, where the brightness of emissions around Uranus increased four times from one day to the next.

According to the researchers, "this may be indicative of additional X-ray emission processes at Uranus," besides mere solar scattering.

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

What mysterious phenomenon could be generating the X-rays from Uranus? One possibility lies in the planet's rings. According to the researchers, the environment around Uranus is rich in charged particles such as protons and electrons; these particles could be colliding into the planet's rings, producing X-rays in the process. (A similar phenomenon has been observed in Saturn's rings, the team wrote.)

It's also possible that the X-rays are the result of some sort of auroral process, in which charged particles from the sun are colliding with Uranus' magnetic-field lines and causing a distinct glow. However, further observations are required to flesh out this hypothesis. For now, the X-ray lights of Uranus remain a mystery.

Originally published on Live Science.

livescience.com, 6 April 2021

https://www.livescience.com

Cutting back on waste is possible—if you can afford it

2021-04-05

Amy Ash knew reducing her waste wouldn't be easy. But the cost of wasting less took her by surprise.

"I had always been motivated to not make unnecessary waste," said the Vancouver resident, who started to actively reduce her waste in 2017. At the time, she was working six days a week at low-wage, precarious jobs in the city.

"Where it became difficult was when I would have liked to have gone to the zero-packaging stores. It was almost cruel how expensive everything was."

Each year, Canadians generate roughly 3.2 million tonnes of plastic waste. Almost a third of it is packaging, and only nine per cent is recycled, according to a 2019 report commissioned by Environment and Climate Change Canada (ECCC).

With growing concern about the environmental impacts of plastic waste, more Canadians are actively trying to reduce the amount of trash they produce. Packaging-free (or "zero-waste") groceries are popping up across the country — packaging alone is responsible for about a third of the country's plastic waste, the ECCC report found — and encouragements to "reduce, reuse, and repurpose" are increasingly common.

Yet, despite the minimalist ethos driving the shift, reducing waste is a privilege.

Yet, despite the minimalist ethos driving the shift, reducing waste is a privilege.

"There is a real association between wealth and being a good environmental citizen," said Myra Hird of Queen's University, a fellow of the Royal Society of Canada and an expert on waste. Shopping at zero-waste or health food stores is often more expensive than buying food at larger chain supermarkets, where avoiding packaging is near impossible, she said.

For many Canadians, reducing waste could be a trade-off between having money for food and other necessities, or reducing their environmental footprint. In June, Statistics Canada reported that about 5.1 million Canadians had lacked food at least once in the previous month. With an increasing number of people facing precarious financial situations as the pandemic wears on, experts anticipate hunger — a symptom of poverty — will be on the rise.

"There is a real association between wealth and being a good environmental citizen," says Myra Hird of @Queensu. #Packaging #Plastics #Recycling

It's a social ill driven by low-wage, precarious work: Wages are the main source of income for about 65 per cent of food-insecure people, according to PROOF, a research team investing policy and food insecurity. Low wages hit women, Indigenous people, and people of colour particularly hard, noted a 2019 report by the Canadian Centre for Policy Alternatives.

Nationally, the annual income for someone working full-time at minimum wage is, on average, $27,000. For many, that's not enough to get by, and they need to take on two — or more — jobs to make ends meet. That time commitment can make reducing waste even harder.

"Income isn't just about being able to buy things that are more expensive (and) eco-friendly," said Hird. "It's also about having the time to do that."

Buying clothes second-hand, searching out less-packaged products, cooking more — common techniques to cut back on waste — all require time. For people working long hours or who have other time commitments, like child care or elder care, finding the time to cut back on waste is difficult, she said.

Ash concurred. While working six days a week, she only had her day off to shop for groceries. But purchasing packaging-free food meant hopping between four grocery stores scattered across Vancouver: Bulk goods stores

CHEMWATCH
Bulletin Board
Curiosities
APR. 16, 2021

like Bulk Barn or Costco for dry goods, a local greengrocer's for produce, and a supermarket for miscellaneous necessities.

"It was crazy — it was the only thing that I would do," she said.

Clothing was easier, she said, with clothing swaps, thrift stores, and gifts from friends keeping her comfortably dressed without waste.

Still, the costs of zero-waste living aren't limited to consumers. The stores working to reduce the amount of packaging for products they sell also face financial hurdles.

"There are things that are pricier that are zero-waste, and the reason is that we're often working with small-batch producers, in a local context, to bring you items that are not mass-produced," said Emily Sproule, owner of JARR, a package-free grocery delivery service in Vancouver.

Wholesale distributors often couldn't provide her business with minimally packaged goods, leading her to work more closely with smaller, local — and often more expensive — farmers and food processors. Larger grocery chains likely face similar issues when it comes to reducing the waste they and their customers produce, she said.

"We've built systems around plastic production … I really believe that reusable systems are not that hard, but we've got into this pattern of distribution that has to do with disposable and mostly plastic (packaging)," she explained. "What I really hope is that small companies like mine ... are a signal to bigger companies that this can be done and (that) this should be part of our day-to-day life and not an outlier."

It's also likely that zero-waste products would be more affordable if they were more widespread. Packing-free supply chains are currently much smaller than conventional ones, but as they grow, it will be possible to make greater economies of scale, she said.

Some major retailers have started to shift their practices. For instance, in February, Loblaw Companies Ltd. — Canada's largest grocery chain, which owns Great Canadian Superstore, No Frills, and other brands — announced a partnership with the global reuse platform Loop. The agreement will let customers in Ontario purchase dozens of products like ice cream, sauces, and pet food in reusable containers, which are returned to Loop after use to be washed and refilled.

Companies alone can't solve the problem, Hird said. Reducing waste is tied into crafting government policies that ensure people have adequate

incomes — and that the plastics industry reduces its production. But until those kinds of policies are implemented, becoming zero waste will be too expensive for many Canadians.

"Zero-waste … I feel like privileged people can afford it, and people who are struggling to get by simply can't," said Ash.

nationalobserver.com, 5 April 2021

https://www.nationalobserver.com

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

CHEMICAL EFFECTS

Acute toxic effect of typical chemicals and ecological risk assessment based on two marine microalgae, Phaeodactylum tricornutum and Platymonas subcordiformis

In silico prediction of polyethylene-aqueous and air partition coefficients of organic contaminants using linear and nonlinear approaches

ENVIRONMENTAL RESEARCH

Occurrence and abundance of poly- and perfluoroalkyl substances (PFASs) on microplastics (MPs) in Pearl River Estuary (PRE) region: Spatial and temporal variations

Effective remediation of petrochemical originated pollutants using engineered materials with multifunctional entities

Environmental applications of microbial extracellular polymeric substance (EPS): A review

OCCUPATIONAL

Plastic additives and personal care products in south China house dust and exposure in child-mother pairs

Occupational Exposure to Second-Hand Tobacco Smoke: Development of a Job Exposure Matrix

Relationship between the expression of TNFR1-RIP1/RIP3 in peripheral blood and cognitive function in occupational Al-exposed workers: A mediation effect study

Occupational exposure to nanoparticles originating from welding - case studies from the Czech Republic

PHARAMACEUTICAL/TOXICOLOGY

Knowledge and Practices on the Safe Handling of Cytotoxic Drugs Among Oncology Nurses Working at Tertiary Teaching Hospitals in Addis Ababa, Ethiopia