CHEMWATCH

Bulletin Board

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OCT. 15, 2021

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APVMA, 5 September 2021

https://apvma.gov.au/node/92216

Agricultural Labelling Code Review

2021-10-08

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is conducting a review of the labelling requirements for agricultural products as set out in the Agricultural Labelling Code (ALC).

The objectives of the review, which will be conducted by the APVMA's Pesticides Team, are to ensure the ALC is:

- consistent in all matters of advice across all sections of the ALC
- administered consistently across the APVMA
- provided in a clear and concise format on our website
- easy to use, navigate and find information.

The scope of the review does not include any amendment that would require legislative change.

In undertaking this exercise, the APVMA will review all general and specific labelling requirements of the ALC and submit these in batches to industry and other interested bodies for consideration and comment.

We will also improve the presentation, accessibility and functionally of the ALC on the APVMA website and will make the test pages available to industry for final review before undertaking a public consultation.

PDF (559.32 KB) | DOCX (166.7 KB)

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We anticipate the review of label content will begin in late 2021, with the release of the first batch of content for comment scheduled to begin in 2022 and end in early 2024. Public consultation and final revision of the updated ALC is expected towards the end of 2024.

The APVMA will review all feedback received and seek further stakeholder consultation where necessary.

Read More

APVMA, 8 October 2021

https://apvma.gov.au/node/92441

AMERICA

US FDA questions safety of sunscreens, again

2021-09-27

Agency requests safety, efficacy data for a dozen common chemical UV filters

The US Food and Drug Administration is reverting back to a 2019 proposal that requires sunscreen manufacturers to demonstrate that their active ingredients are generally recognized as safe and effective (GRASE). The agency announced its decision Sept. 24 in a proposed order that is intended to replace an order attached to the 2020 Coronavirus Aid, Relief and Economic Security (CARES) Act.

The CARES Act overhauled the FDA's over-the-counter drug approval process and deemed several sunscreen ingredients as GRASE. The FDA had requested safety and efficacy data for 12 of those sunscreens in 2019, but under the CARES Act such data were no longer necessary. Now, the agency is once again asking for the data to demonstrate the substances are GRASE.

The sunscreen ingredients in question are avobenzone, cinoxate, dioxybenzone, ensulizole, homosalate, meradimate, octinoxate, octisalate, octocrylene, oxybenzone, padimate O, and sulisobenzone. Zinc oxide and titanium dioxide would maintain their GRASE status without additional data.

The FDA is seeking safety data for the 12 chemicals because new research shows that some of them are absorbed through the skin (*JAMA* 2020, DOI: 10.1001/jama.2019.20747). The Environmental Working Group (EWG), an

The CARES Act overhauled the FDA's over-the-counter drug approval process and deemed several sunscreen ingredients as GRASE.

advocacy organization, claims that some of the chemicals are potential endocrine disruptors.

"Sunscreen chemicals like oxybenzone pose significant health concerns, but the sunscreen industry continues to bury its head in the sand," Scott Faber, the EWG's senior vice president for government affairs, says in a statement. "We're grateful the FDA continues to demand basic data on the health effects of these chemicals."

Read More

Chemical & Engineering News, 27 September 2021

https://cen.acs.org/safety/consumer-safety/US-FDA-questions-safety-sunscreens/

PFAS Georgia Rulings Open Door To Downstream Liabilities

2021-09-27

In June 2021, we detailed various PFAS lawsuits in Georgia stemming from alleged drinking water pollution from the carpet manufacturing industry based in Dalton, Georgia (the "carpet capital of the world"). The lawsuits allege that the numerous carpet manufacturers in the region have for years polluted waterways and drinking water sources with PFAS, which will cost tens of millions of dollars to remediate. Last week, a Georgia federal judge presiding over one of the federal cases issued a 180 page Order (Georgia PFAS Case Order) that allowed many of the claims to proceed against water districts and carpet manufacturers, but dismissed various claims against PFAS manufacturers such as 3M and DuPont. While the chemical manufacturers remain in the case on some claims, the PFAS Georgia rulings will have enormous impacts on the future of the PFAS litigation, as it presents the possibility that the PFAS chemical manufacturers (who have thus far born the brunt of legal liability for PFAS environmental pollution claims) may in some instances be off the hook, with downstream companies and water utilities left with legal liability.

PFAS In The Carpet Capital Of The World

Dalton, Georgia sits in the northern region of the state and since the 1990s, the area has produced almost 90% of the world's carpet. The carpet industry utilizes PFAS in many carpet applications, in particular to make carpets that are stain resistant. The waste from the carpet manufacturing facilities was historically sent by way of effluent to Dalton Utilities, which

The lawsuits allege that the numerous carpet manufacturers in the region have for years polluted waterways and drinking water sources with PFAS, which will cost tens of millions of dollars to remediate.

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ultimately feeds into the Conasauga River, about an hour and a half north of Atlanta. The Conasauga River flows south and supplies water to numerous waterways, including the Oostanaula River, which runs through the city of Rome. Rome once used up to ten million gallons of water a day from the Oostanaula, but it stopped using the river as its main drinking water source in 2016 due to PFAS concerns.

PFAS Georgia Rulings

In 2019, a class action lawsuit was filed in Georgia state court (the lawsuit was later removed to federal court) by citizens that obtain their drinking water from Rome, including adjacent cities that purchase drinking water from Rome. The lawsuit is styled as *Jarrod Johnson v. 3M, et al.*, 19-CV-02448JFL003. In the lawsuit, the citizens allege that carpet manufacturers and chemical suppliers (e.g. – 3M, DuPont, etc.) contaminated their drinking water with PFAS and caused the following damages: (1) pollution of drinking water constituting a nuisance, (2) increased costs for drinking water that municipalities passed on to consumers due to the necessity of installing PFAS filtration technology, (3) remediation costs to cleanup PFAS from the drinking water supplies, and (4) an injunction request to force the named defendants from any further PFAS discharge into the water supplies.

Twelve Motions to Dismiss were filed on numerous legal grounds, which were all ruled on by the federal court last week. Most of the nuisance and Clean Water Act claims were allowed to move forward. However, the Court also dismissed several claims against "chemical suppliers", such as 3M and DuPont, ruling that they could not have foreseen the pollution issues in question, as they did not directly pollute the riverways and drinking water sources in question.

Read More

The National Law Review, 27 September 2021

https://www.natlawreview.com/article/pfas-georgia-rulings-open-door-to-downstream-liabilities

EPA proposes to codify parent company definition for TRI reporting

2021-09-29

The U.S. Environmental Protection Agency (EPA) published a proposed rule on September 28, 2021, that would codify the definition of "parent

Although the existing regulation requires a facility reporting to TRI to identify its parent company in annual reporting forms, no codified definition of this data element exists.

company" for purposes of reporting to the Toxics Release Inventory (TRI). **86 Fed. Reg. 53577**. Although the existing regulation requires a facility reporting to TRI to identify its parent company in annual reporting forms, no codified definition of this data element exists. EPA states that a codified definition of parent company would allow it to address various corporate ownership scenarios explicitly and reduce the reporting burden caused by regulatory uncertainty. The proposed rule would clarify existing regulations to reporting facilities and add a foreign parent company data element, if applicable, while improving data quality. The proposed rule addresses the following ownership scenarios:

- A facility is owned by a single company that is not owned by another company;
- A facility is owned by a single company that is owned by another company;
- A facility is owned by multiple companies, including companies that are themselves owned by other entities;
- A facility is owned by a joint venture or cooperative;
- A facility is owned, at least in part, by a foreign company; and
- A facility is owned by the federal government, or a state, tribal, or municipal government.

Read More

TSCA Blog, 29 September 2021

http://www.tscablog.com/entry/epa-proposes-to-codify-parent-company-definition-for-tri-reporting

Recording of the First International Conference on Agricultural Law Available Now

2021-09-29

The **First International Conference on Agricultural Law** was held jointly by the Agricultural Law Section of the International Bar Association (IBA), Project Pravo-Justice, and the Ukrainian Bar Association (UBA) on September, 23-24, 2021. This conference provided a unique review of current legal issues in agriculture, with leading European and Ukrainian experts sharing their experience on

- Land reform in Ukraine and best practices worldwide;
- Climate change, the European Union (EU) Green Deal, and sustainable development;

A complimentary recording of this informative event is now available to stream.

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- Technology, agriculture, and trade;
- International trade;
- Infrastructure; and
- Taxation.

A complimentary recording of this informative event is now available to **stream**. Bergeson & Campbell, P.C. (B&C®) is pleased to share this valuable resource with clients and friends. B&C Managing Partner **Lynn L. Bergeson** is the Senior Vice Chair of the IBA's Agricultural Law Section.

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Pesticide Law and Policy Blog, 29 Septmeber 2021

http://pesticideblog.lawbc.com/entry/recording-of-the-first-international-conference-on-agricultural-law-availab

EUROPE

Measures to limit chemical migration from recycled paperboard

2021-09-23

Review identifies and discusses three approaches to limit chemical migration from recycled paperboard to make it acceptable for food applications; considers internal bags with an incorporated barrier, barrier layers, and functional sorbents added to the board; study on migration from paper cups identifies exposures to vanadium and fluoride

In a review published on September 15, 2021, in the journal *Food Additives & Contaminants: Part A*, Koni Grob, retired from the *Official Food Control Authority of the Canton of Zurich*, Switzerland, discusses approaches to reduce chemical migration from recycled paperboard such that it meets current safety requirements for food packaging applications.

Previous studies have demonstrated that chemicals migrate from paper and board packaging – even in amounts exceeding migration from plastics (FPF reported) – and that especially recycled paperboard can leach a high number of (toxic) contaminants into food (FPF reported). Still, recycled paperboard is seen as advantageous in terms of sustainability. As he considers the reduction of the number of chemicals and the completion of safety evaluation of each substance as unrealistic to archive, Grob proposes to limit chemical migration instead. In the review, he

Still, recycled paperboard is seen as advantageous in terms of sustainability.

evaluates three measures to limit migration concerning the previously derived criterion that migration of individual compounds from recycled paperboard folding boxes used to pack dry food should be below 1% by weight of its content in the material (FPF reported).

The article emphasizes that "the measures to be taken strongly depend on the application of the recycled paperboard…to keep migration low for extended periods of time." The three measures Grob discusses include (1) internal bags with an incorporated barrier, (2) barrier layers, and (3) functional sorbents added to the board. The review finds that internal bags are available and can be customized for an application, but they may not be suitable for very humid food. In contrast, barrier layers with a sufficient barrier function can be difficult to apply, care needs to be taken to prevent set-off during storage and to avoid migration from chemicals on the external surface through closures into the food. Concerning the measure of functional sorbents, Grob describes that they represent a promising simple solution but "further work is needed to ensure the effectiveness, in particular with regard to the sorption capacity, and to develop a corresponding testing method." Transport boxes, mostly made of corrugated board and less considered when analyzing the safety of food packaging, are also discussed. Here, the author concludes that "[m] igration may be substantial and overall might contribute to the exposure of the consumers more than the folding boxes," and that a specific safety criterion is still needed for transport boxes.

Read More

Food Packaging Forum, 23 September 2021

https://www.foodpackagingforum.org/news/measures-to-limit-chemical-migration-from-recycled-paperboard

Guidance on regulatory classification of point-of-use hospital water filters in the UK

2021-10-01

The MHRA position on the appropriate classification of point-of-use water filters for the UK market, and advice for suppliers and procurers of these products

Details

Scope

The MHRA do not consider POU water filters to be medical devices, nor are they considered to be accessories of medical devices.

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This guidance covers "point-of-use" (POU) water filters which are intended to be fitted to various access points for tap water in the healthcare environment, such as faucets and showerheads, to reduce bacterial contamination of the tap water that may occur as the water passes through the water pipelines. The filtered water produced may then be used for multiple purposes.

This may include general purposes such as drinking water or water for personal hygiene. Filtered water may also be provided in areas treating vulnerable patients who may be more at risk of bacterial infection, for example in burn wards, oncology units and NICUs.

Classification of hospital water filters for the UK market

The MHRA do not consider POU water filters to be medical devices, nor are they considered to be accessories of medical devices.

This was discussed at EU level in 2018. The competent authorities of the EU Member States, which included the UK at the time, reached a consensus that these products should be regarded as general hospital equipment and not medical devices. The MHRA has maintained this position since 2018.

The outcome of this discussion is recorded in the "Manual of Decisions" on borderline and classification of medical devices.

The MHRA therefore do not consider POU water filters to fall under the scope of UK or EU medical device legislation for the purposes of the UK market.

If you intend to supply or procure these products

Suppliers and procurers alike should be aware that the MHRA do not consider these products to fall under the legislation for medical devices. This means that filters intended for the UK market should not carry the UKCA mark, CE UKNI mark or CE mark to indicate compliance with UK or EU medical device legislation.

These markings of conformity should only be applied to products which fall under the scope of one of the product areas for which the UKCA/CE UKNI/CE mark is required, and which fully comply with the applicable legal requirements.

Please refer to this guidance for a list of product areas which require UKCA marking.

Since these filters should not carry the UKCA, CE UKNI or CE mark, the use of one of these markings does not automatically indicate a superior product, and may in fact indicate that the marking has been incorrectly affixed.

Procurers of POU water filters should review the full available product information to determine which particular POU filter is most suitable for your establishment's needs, irrespective of UKCA/CE UKNI/CE marking status.

Suppliers of these products may wish to contact their local Trading Standards for further regulatory advice.

Read More

Gov.UK, 1 October 2021

https://www.gov.uk/government/publications/guidance-on-regulatory-classification-of-point-of-use-hospital-water-filters-in-the-uk

PET chemical recycling needs clarity on mass balance methodology, EU regulation

2021-10-07

The International Organization for Standardization's (ISO) definition of a mass balance methodology will be key for the European polyethylene terephthalate (PET) chemical recycling industry to progress, while further clarity on whether chemical recycling will count towards EU recycled content goals is still needed, speakers at a Petcore industry event said.

Speaking at the Petcore Monomer Recycling Webinar, Kristin Olofsson, Director Regulatory Affairs & Strategic Innovation, Chair ISO/TC61/SC14/WG 5 Mechanical & Chemical Recycling, said the ISO needs to publish details on ISO TC 308 Chain of Custody before European regulators can come up with their own set of definitions and methodologies for the mass balance approach to be used in chemical recycling.

The ISO is an independent, non-governmental international organisation made up of 166 national standards bodies, and aims to develop voluntary, consensus-based, market relevant international standards that support innovation and provide solutions to global challenges.

Set up in 2016, the scope of ISO TC 308 is to create standardisation in the field of chain of custody (CoC) for products and associated processes with specified characteristics, with the aim of ensuring that associated claims

The ISO project committee was established with a view to making traceability simpler for all supply chain actors by using a uniform ISO language globally.

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are reliable. Its aim is to ensure traceability and transparency across all products, from food and drink to textiles and apparel, and now, chemical recycling.

The ISO project committee was established with a view to making traceability simpler for all supply chain actors by using a uniform ISO language globally.

Conversations about chemical recycling go hand in hand with a discussion on how to measure the amount of recycled content in chemically recycled material, and mass balance is a popular approach for this.

In mass balance, a certified volume of renewable or recycled material is input across a production run, but may not be evenly distributed across each individual product.

For example, a plant may use 30% recycled material overall, but one piece of produced packaging could contain 100% recycled material, and the next 100% virgin material, or any mix between those two extremes.

Via this method, market players are able to state that they use a certain percentage of recycled or renewable material in their products, without having to prove that percentage in each individual product produced.

Currently the mass balance model has not been agreed, which is one part of the problem, and another is a lack of definition on how to calculate the recycled content in the material produced, Olofsson said.

Other areas where definitions are still missing include a verification scheme on the chemical recycling process as well as an environmental footprint methodology.

When looking at the European market for chemical recycling, Olofsson said the ISO needs to come up with a definition for mass balance under ISO TC 308 so that Europe can use this as a guideline.

"If we develop a standard before ISO TC 308 finalise their work, we may come into a contradictory discussion," Olofsson said.

Read More

ICIS, 7 October 2021

https://www.icis.com/explore/resources/news/2021/10/07/10692348/pet-chemical-recycling-needs-clarity-on-mass-balance-methodology-eu-regulation

INTERNATIONAL

Clean environment could become U.N. human right. Not so fast, say U.S., Britain

2021-10-06

Britain and the United States are among a few countries withholding support for a proposal brought at the United Nations that would recognise access to a safe and healthy environment as a human right, prompting criticism that they are undermining their own pledges ahead of the Glasgow climate conference.

Diplomats say the Geneva-based Human Rights Council is expected to adopt the resolution later this week even if an opposing country calls a vote, as supporters are numerous and include Costa Rica, the Maldives and Switzerland.

If adopted, environmental defenders say it will pressure countries to join the more than 100 nations that already recognize a legal right to healthy surroundings. And while the resolution would not be binding, lawyers say it will shape norms and help campaigners develop arguments in climate cases.

The World Health Organization estimates that some 13.7 million deaths a year, or around 24.3 % of the total, are due to environmental risks such as air pollution and chemical exposure. read more

Read More

Reuters, 6 October 2021

https://www.reuters.com/business/environment/clean-environment-could-become-un-human-right-not-so-fast-say-us-britain-2021-10-05

If adopted, environmental defenders say it will pressure countries to join the more than 100 nations that already recognize a legal right to healthy surroundings.

UK REACH: Grandfathered registration notified substances list

2021-10-01

Defra has published a "UK REACH: grandfathered registration notified substances list" on GOV.UK.

The list contains the names and CAS/EC numbers for substances taken from notifications made under Article 127B(4)(a) of UK REACH.

Article 127B(4)(a) is the provision that required registrants of a former EU REACH registration "grandfathered" into UK REACH to notify HSE of basic information about their registration ("initial transitional data").

This initial transitional data was submitted to HSE using the Comply with UK REACH service.

The list covers data provided up to and including 1 July 2021.

The substance information on the list has been taken from initial transitional data and so its accuracy is not guaranteed.

The list is not a verified list of all substances with registrations that were transferred into UK REACH from EU REACH under Article 127A(1) (transferred registrations).

A substance with a transferred registration will not appear on the list if:

- No initial transitional data has been submitted;
- Those who submitted the initial transitional data indicated that it was confidential

A substance will also not appear on the list if the substance is only imported by a new registrant or a former downstream user or distributor.

GB-based companies that, prior to the end of the transition period, were downstream users or distributors under EU REACH are required to notify HSE of their downstream user/distributor status by submitting a Downstream User Import Notification (DUIN). This will suspend the registration duty they now have as importers.

See the Downstream User Import Notification guidancefor more information.

A DUIN needs to be submitted before 27 October 2021.

The list covers data provided up to and including 1 July 2021.

REACH Update

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Read More

HSE, 1 October 2021

https://www.gov.uk/government/publications/uk-reach-grandfathered-registrations-notified-substances-list

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Janet's Corner

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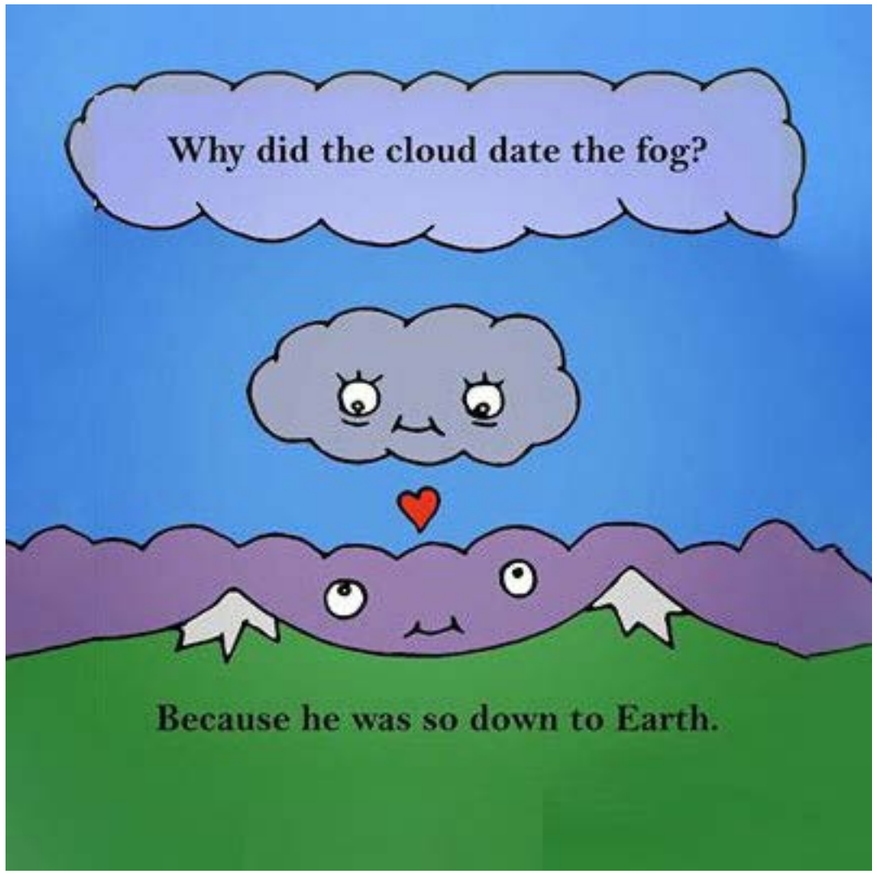
Down to Earth

2021-10-15



https://www.calpaclab.com/science-jokes/

Methane

2021-10-15

Methane is a colourless, odourless, and extremely flammable gas that can be explosive when mixed with air. It is also called methyl hydride. Methane can be a liquid that needs to be refrigerated. Methane is emitted from several natural and human-related sources. The chemical formula for methane is CH_4.Methane is the primary component of natural gas. Other natural sources of methane include permafrost, termites, oceans, bodies of fresh water, wildfires, mud volcanoes, decaying matter in wetlands, digestive processes of animals, and underground and underwater deposits of methane called methane clathrates.[1]

USES [2]

- Methane is used in industrial chemical processes and may be transported as a refrigerated liquid (liquefied natural gas, or LNG).
- Gas pipelines distribute large amounts of natural gas, of which methane is the principal component.
- Methane is important for electrical generation by burning it as a fuel in a gas turbine or steam boiler.
- Methane in the form of compressed natural gas is used as a vehicle fuel and is claimed to be more environmentally friendly than other fossil fuels such as gasoline/petrol and diesel.
- Liquefied natural gas or LNG is natural gas (predominantly methane, CH4) that has been converted to liquid form for ease of storage or transport.
- In a highly refined form, liquid methane has been investigated as a rocket fuel.
- In the chemical industry, methane is converted to synthesis gas, a mixture of carbon monoxide and hydrogen, by steam reforming.
- Related chemistries are exploited in the Haber-Bosch Synthesis of ammonia from air, which is reduced with natural gas to a mixture of carbon dioxide, water, and ammonia.
- Methane is also subjected to free-radical chlorination in the production of chloromethanes, although methanol is a more typical precursor.

Methane is a colourless, odourless, and extremely flammable gas that can be explosive when mixed with air.

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SOURCES & ROUTES OF EXPOSURE

Sources of Exposure [3]

- Breathing: Most exposures occur when people inhale methane. Methane can go into homes through sewer traps or foundation cracks. People can be exposed by inhaling the chemical at work, cooking on a gas stove, or entering confined spaces such as manholes, silos, animal waste pits, septic tanks and sewers.
- Drinking/Eating: Because methane evaporates quickly, it is usually not found in food or drinking water. Very low-level exposure can occur when contaminated water is used for drinking and/or for food preparation or when children eat contaminated soil.
- Touching: Methane gas does not pass readily through intact skin. Methane in its extremely cold liquefied form can, however, cause burns to the skin and eyes.

Routes of Exposure [4]

The main routes of exposure to methane are via inhalation and contact with skin and/or eyes.

HEALTH EFFECTS [4]

Acute Effects

- Inhalation: Low concentrations are not harmful. A high concentration can displace oxygen in the air. If less oxygen is available to breathe, symptoms such as rapid breathing, rapid heart rate, clumsiness, emotional upsets and fatigue can result. As less oxygen becomes available, nausea and vomiting, collapse, convulsions, coma and death can occur. Symptoms occur more quickly with physical effort. Lack of oxygen can cause permanent damage to organs including the brain and heart.
- Skin Contact: Not irritating. Direct contact with the liquefied gas can chill or freeze the skin (frostbite). Symptoms of mild frostbite include numbness, prickling and itching. Symptoms of more severe frostbite include a burning sensation and stiffness. The skin may become waxy white or yellow. Blistering, tissue death and infection may develop in severe cases.
- Eye Contact: Not irritating. Direct contact with the liquefied gas can freeze the eye. Permanent eye damage or blindness can result.
- Ingestion: Not a relevant route of exposure (gas).

Chronic Effects

- Methane has no ongoing harmful effects.

Cancer Risk

- Methane is not a carcinogen.

SAFETY [4]

First Aid Measures

- Inhalation: Take precautions to prevent a fire (e.g. remove sources of ignition). In case of oxygen deficiency: take precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). Move victim to fresh air. Keep at rest in a position comfortable for breathing. If breathing is difficult, trained personnel should administer emergency oxygen. If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Immediately call a Poison Centre or doctor. Treatment is urgently required. Transport to a hospital.
- Skin Contact: Not applicable (gas). Liquefied gas: quickly remove victim from source of contamination. DO NOT attempt to rewarm the affected area on site. DO NOT rub area or apply direct heat. Gently remove clothing or jewellery that may restrict circulation. Carefully cut around clothing that sticks to the skin and remove the rest of the garment. Loosely cover the affected area with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Immediately call a Poison Centre or doctor. Treatment is urgently required. Transport to a hospital.
- Eye Contact: Not applicable (gas). Liquefied gas: immediately and briefly flush with lukewarm, gently flowing water. DO NOT attempt to rewarm. Cover both eyes with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Immediately call a Poison Centre or doctor. Treatment is urgently required. Transport to a hospital.
- Ingestion: Not applicable (gas).

Fire Hazards & Extinguishing Media

- Flammable Properties: Methane is a flammable gas, which can easily ignite. In addition, it can readily form explosive mixture with air at room temperature and may be ignited by static discharge.

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- Suitable Extinguishing Media: Dry chemical powder and high-expansion foam. Foam manufacturers should be consulted for recommendations regarding types of foams and application rates.
- Unsuitable Extinguishing Media: DO NOT use carbon dioxide, low expansion foams, and direct application of water on liquefied gas.

Specific Hazards for Methane

- Gas or vapour may travel a considerable distance to a source of ignition and flash back to a leak or open container.
- Gas or vapour may accumulate in hazardous amounts in low-lying areas especially inside confined spaces, resulting in a health hazard. Methane can displace oxygen in the air, causing suffocation.
- Direct addition of water to liquefied gas will cause flash vaporisation resulting in an explosion (either immediately or delayed) known as a "boiling liquid, expanding vapour explosion (BLEVE)".
- Heat from fire can cause a rapid build-up of pressure inside cylinders. Explosive rupture and a sudden release of large amounts of gas may result. Cylinder may rocket.
- In a fire, the following hazardous materials may be generated: very toxic carbon monoxide, carbon dioxide.

Engineering Controls

- Use local exhaust ventilation, if general ventilation is not adequate to control amount in the air.
- Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas where this product is used and stored.
- Do not allow product to accumulate in the air in work or storage areas, or in confined spaces.
- For large-scale use of this product: use stringent control measures such as process enclosure to prevent product release into the workplace.

Personal Protective Equipment

The following personal protective equipment is needed when working with methane:

- Eye/Face Protection: Wear chemical safety goggles and face shield when contact is possible.

- Skin Protection: Always wear insulated protective clothing, if contact with refrigerated gas is possible. For cryogenic liquids, materials include: Tychem® Responder.
- Respiratory Protection: Not normally required. If the oxygen content of the air is below acceptable limits, wear a NIOSH approved self-contained breathing apparatus (SCBA) or supplied air respirator.

REGULATIONS

United States

- ACGIH: The American Conference of Industrial Hygienists has set a threshold limit value (TLV) for methane of 1000ppm over an 8-hour workshift.

REFERENCES

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2. http://en.wikipedia.org/wiki/Methane
3. http://www.dhs.wisconsin.gov/eh/chemfs/fs/Methane.htm
4. http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/methane.html

Giant ground sloths may have been meat-eating scavengers

2021-10-07

Modern sloths may be dedicated vegetarians, but at least one of their massive Ice Age cousins chowed down on meat when it had the chance. Darwin's ground sloth — which could grow to over 3 meters long and weigh as much as about 2,000 kilograms — may have been an opportunistic scavenger, chemical analyses of fossil sloth hair suggest.

Paleontologist Julia Tejada of the University of Montpellier in France and colleagues analyzed the chemical makeup of two amino acids, the building blocks of proteins, within the fossil hair of two giant ground sloth species: Darwin's ground sloth (Mylodon darwinii) of South America and the Shasta ground sloth (Nothrotheriops shastensis) of North America (SN: 4/25/18). The team compared these with samples from living sloths, anteaters and other modern omnivores.

Nitrogen isotopes, different forms of the element, can vary a lot among different food sources as well as between ecosystems. Those isotope values in one amino acid, glutamine, change significantly with diet, increasing the higher the animal is on the food chain. But diet has little impact on the nitrogen values in another amino acid, phenylalamine. By comparing the nitrogen isotopes in the two amino acids found in the sloths' hair, the researchers were able to eliminate ecosystem effects and zoom in on diets.

Nitrogen isotopes, different forms of the element, can vary a lot among different food sources as well as between ecosystems.

The data reveal that while the diet of the Shasta ground slothwas exclusively plant-based, Darwin's ground sloth was an omnivore, Tejada and colleagues report October 7 in Scientific Reports.

The findings upend what scientists thought they knew about the ancient animals. Scientists have assumed the ancient creatures were herbivores. That's in part because all six modern species of sloth are confirmed vegetarians, and in part giant ground sloths' teeth and jaws weren't adapted for hunting or powerful chewing and tearing (SN: 6/20/16).

But Darwin's ground sloth could have managed to ingest already-killed meat, Tejada and colleagues say. And that might help solve a long-standing puzzle: the apparent absence of large carnivorous mammals in South America at the time. Darwin's ground sloth, the researchers add,

may have filled a vacant ecological niche: the scavenger who wouldn't say no to a meaty meal.

sciencenews.org, 7 October 2021

https://www.sciencenews.org

World's 1st malaria vaccine recommended by WHO

2021-10-07

The World Health Organization (WHO) has recommended the widespread use of a malaria vaccine among children in Africa and other areas of high malaria transmission — a breakthrough in the long fight against the deadly disease.

Malaria is a parasite-caused disease that's been around for thousands of years and is transmitted primarily via mosquito bites. It kills more than 400,000 people around the world each year, mainly in sub-Saharan Africa. More than 260,000 children under age 5 die each year from malaria.

The road to an effective malaria vaccine has been long, with many vaccines showing only modest efficacy, Live Science previously reported. The vaccine WHO has endorsed — called RTS, S, or Mosquirix — is more than 30 years in the making and works to prime the immune system against Plasmodium falciparum — the deadliest malaria parasite and the most common one in Africa.

LAY SOUND

It is the first vaccine to complete large-scale clinical trials and show that it can significantly reduce malaria, including life-threatening malaria, in young children in Africa, according to the WHO. It is also the first vaccine developed against any disease caused by a parasite, according to The New York Times.

"This is a historic moment. The long-awaited malaria vaccine for children is a breakthrough for science, child health and malaria control," Dr. Tedros Adhanom Ghebreyesus, the WHO's director-general, said in a statement Wednesday (Oct. 6). "Using this vaccine on top of existing tools to prevent malaria could save tens of thousands of young lives each year."

In large-scale clinical trials, the vaccine, developed by U.K. healthcare company GlaxoSmithKline, prevented around 4 in 10 cases of malaria — a 39% efficacy — across a period of four years, in children who received the

It kills more than 400,000 people around the world each year, mainly in sub-Saharan Africa.

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four doses, according to the WHO. The vaccine prevented 3 in 10 cases — a 29% efficacy — of severe malaria.

Following the clinical trial results, the WHO recommended that the vaccine be piloted in select areas across Ghana, Kenya and Malawi.

Since 2019, more than 800,000 children in those countries have been vaccinated through these programs, according to the WHO. The vaccine, which is given in four doses to children starting at 5 months of age, was shown to be safe and led to a 30% reduction in deadly severe malaria cases, even when distributed in areas that widely used insecticide-treated nets and where there is good access to treatment.

Currently, malaria in high-transmission areas is controlled mainly by spraying houses with insecticide once or twice a year or sleeping under insecticide-treated mosquito nets.

Another study, published in September in The New England Journal of Medicine, found that when children were given an anti-malarial drug along with the vaccine, the combination reduced hospitalization with severe malaria by 70.5% and death by 72.9% as compared with just the anti-malarial drug. One modeling study, published in November 2020 in the journal PLOS Medicine, found that the vaccine could prevent 5.3 million cases and 24,000 deaths among children 5 years and younger every year.

If the global vaccine alliance Gavi determines that the malaria vaccine is indeed a good investment, the organization will purchase the vaccines for countries that want it, according to the Times.

Other malaria vaccine candidates are currently being tested. One of these vaccines, developed by researchers at the University of Oxford, showed 77% efficacy in early clinical trials — the only malaria vaccine to pass the WHO's goal of achieving at least 75% efficacy by 2030, Live Science reported. Larger-scale trials are now starting on that vaccine, according to The Guardian.

A second malaria vaccine would be "highly beneficial" to malaria control, especially in helping to meet the anticipated high demand, according to the WHO.

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https://www.livescience.com

'The water used to be up to your armpits': birds starve as Turkey's lakes dry up

2021-10-07

"If we stood in this spot a few years ago, the water would be up to your armpits," says vet Isa Agit, standing on sun-hardened and cracked mud that used to be part of a lake in eastern Turkey, with his hands firmly wrapped around a long-legged buzzard. "That's the last of the flamingos over there," he adds, pointing to what is left of the lake in the village of Enginsu – a patch of water just visible in the distance.

Over the past 50 years, 60% of Turkey's 300 natural lakes have dried up and the loss is devastating for birds and other wildlife. Reduced rainfall, rising temperatures, the mismanagement of public land and poor agricultural practices have caused water levels, even in the Middle East's second largest lake, Lake Van, to recede by as much as 200 metres.

Migratory birds have been particularly affected by the change – between 3,000 and 5,000 young flamingos died of starvation in July after the waters of Lake Tuz, in central Anatolia's Konya basin, receded too far for them to reach the shore from their nests. The impact on ecosystems has also caused mass gull deaths and birds of prey are falling sick from infections caused by changes to their diet.

Agit, who works at Yüzüncü Yıl University's Wild Animal Protection and Rehabilitation Centre in the city of Van, said this year's fish migration lasted two and a half months – half its usual length – because of the lack of rain. As a result, gulls and other birds have turned to eating unnatural foods such as rubbish and dead animals, which can ultimately kill them due to parasites.

"Birds don't have enough food, so some are attacking each other," says Agit. "Hawks and eagles don't usually eat crows, but now they do and sometimes they carry diseases of ticks, which might be lethal."

He is preparing to release the long-legged buzzard, whose wing was wounded in a fight with other birds over food – it couldn't hunt and was starving before being brought to Agit at the rehabilitation centre.

Now fit and healthy, Agit holds the bird in the air before letting go. It soars off towards the last patch of lake, flying over dry ground strewn with bird bones. "Two years ago, this mud was not here and it was all wet," says Agit.

Prof Loğman Aslan, director of the centre, says that stress was also a factor in the bird deaths. The drop in food sources and changes to the

Over the past 50 years, 60% of Turkey's 300 natural lakes have dried up and the loss is devastating for birds and other wildlife.

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natural environment were stressing the animals and making them more susceptible to parasites. Other experts have blamed emissions from coal power plants as a contributing factor – Turkey is among the main contributors to Europe's air pollution levels.

It used to be very beautiful here and everywhere was grass. Now it doesn't grow

Yakub, farmer

According to the UN, Turkey is highly vulnerable to the effects of the climate crisis. This year, the Sea of Marmara has experienced an explosion of "sea snot", or phytoplankton, caused by rising temperatures, and the largest forest fires in living memory ravaged the country's south coast. In July, the eastern city of Cizre recorded the country's highest ever temperature at 49.1C.

Many think of Turkey as Europe's rubbish dump, as plastic waste is exported there for recycling, but much of it ends up illegally dumped, burned or left to pollute the seas.

Another lake in eastern Turkey, Lake Akgol, completely dried up this year. Shepherds in the area said that, although drought has been a problem in the region for the past 10 years, this year has been the worst, as there was little snow in the winter due to warmer temperatures, and therefore little meltwater.

"It used to be very beautiful here and everywhere was grass. Now it doesn't grow," says Yakub, 20, a farmer from a village close to Akgol, which is now a greenish patch of parched earth.

"It just happened this year and it was really fast. We used to swim here at this time of year. There were a lot of ducks and pelicans, but now there's almost nothing."

Aside from drought and rising temperatures, one of the biggest challenges facing Turkey's water supplies is that, with the ground so dry, farmers are rerouting water sources for their land and animals. Groundwater supplies are becoming depleted as a result, and little is being done to address the issue.

Poor agricultural practices, along with the use of lake water for large construction projects, and pollution, mean that wetlands are drying out –

and they are a key habitat for migratory birds that come to Turkey from central and north Africa each spring to breed.

According to Turkey's Doğa Derneği, a group of conservation volunteers, almost half of Turkey's wetlands have been irreversibly lost over the past 70 years. It says that currently there are water management plans in place for only 24 of the 76 registered wetlands.

Safak Arslan, a bird of prey specialist with the group, says poor practices and a lack of government policy are destroying the land, and that needs to change. According to Arslan, only a return to traditional Anatolian farming methods, using irrigation terraces and planting indigenous crops such as oregano and lavender, which require little water, can help save the landscape, and therefore the birds.

"Experts are telling us that there will be more unseasonable rains and droughts, yet we haven't taken any precautions against them so far," he says. "We are a water-poor country. We need to take action before the fire breaks out, before the forests disappear and before the wetlands dry up."

theguardian.com, 7 October 2021

https://www.theguardian.com

This trilobite was equipped with a 'hyper-eye' never seen before in the animal kingdom

2021-10-09

The humble trilobite, a helmet-headed creature that swam the seas hundreds of millions of years ago, was hiding an extraordinary secret — a "hyper-eye" never seen before in the animal kingdom.

By poring over X-ray images, researchers found that certain species of trilobite — extinct arthropods distantly related to horseshoe crabs — had "hyper compound eyes," complete with hundreds of lenses, their own neural network to process and send signals and multiple optic nerves, according to new research published Sept. 30 in the journal Scientific Reports.

Today's arthropods, like dragonflies and mantis shrimp, are also known for their powerful compound eyes, which are composed of myriad eye facets called ommatidia, each equipped with its own lens, like a disco ball. PLAY SOUND

Each of their eyes (they had one on the left and one on the right) held hundreds of lenses.

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But, according to the new findings, trilobites from the family Phacops had compound eyes that were far larger and more complex than their modern-day arthropod relatives. Each of their eyes (they had one on the left and one on the right) held hundreds of lenses. At nearly a millimeter across, these primary lenses were thousands of times larger than a typical arthropod's. Nestled beneath them like bulbs in a car headlight sat six (or more) faceted substructures akin to a typical compound eye. "So each of the big Phacopid eyes is a hyper compound eye with up to 200 compound eyes each," study lead author Brigitte Schoenemann, a paleontologist at the University of Cologne in Germany, told Live Science in an email.

Trilobites are creatures that lived from the early Cambrian period (521 million years ago) to the end of the Permian (252 million years ago) on ocean floors. Some may have been predators that hunted aquatic worms, though most were scavengers or plankton eaters. The remains are commonly found in limestone rock from the Cambrian period. But despite their ubiquity in the fossil record, scientists still have questions about their physiology and evolutionary history .

To answer some of those questions, the researchers used photo-enhancing techniques to examine dozens of archival photos, cross referencing them with recent findings. In the process, they also resolved a long-standing scientific debate: They confirmed that a mysterious series of "fibers" seen in X-ray images from more than 40 years ago were actually bundled optic nerves connected to the trilobites' eyes.

"Inferring function in ancient, extinct organisms is always difficult," said Nigel Hughes, a trilobite expert at the University of California Riverside, who was not involved in the study. In fact, Hughes pointed out, even some oddball features on living creatures elude explanation — for example, there is still some debate about the function of narwhals' long, horn-like tooth, according to the Smithsonian Institution.

However, eyes are a bit easier to parse than teeth or horns, Hughes said, because optical systems have only one function: sight. "We know it's an eye from the structure," he said, and therefore it makes sense for the attached filaments to be nerves. "I think that that's pretty convincingly argued in the paper." Why a trilobite might need that much visual power remains a mystery.

The X-ray photos themselves were taken by Wilhelm Stürmer, a professional radiologist and amateur paleontologist from Siemens. In the 1970s, Stürmer mounted an X-ray probe inside his VW bus and created a novel method to study fossils: X-ray paleontology, which allowed him to

peer through solid rock on site and take some of the most sophisticated fossil photos of his day.

Upon examining the Hunsrück Slate, a fossil quarry driving distance from his home in Munich, Germany, Stürmer uncovered a world of petrified creatures embedded in the rock. Remarkably, these specimens — including phacopid trilobites — were so well preserved that even their delicate soft tissues were visible. Stürmer and his collaborator Jan Bergström noted that the trilobites appeared to have fossilized "fibers" connected to their compound eyes, which they described in the June 1973 issue of the journal Paläontologische Zeitschrift.

But when Stürmer brought these findings before other paleontologists, "his colleagues in the scientific world laughed at him," Schoenemann said. The prevailing wisdom at the time was that soft tissue, like nerves, simply did not fossilize. Stürmer must have mistaken gill filaments for optic nerve tissue, his critics argued, according to Schoenemann. The radiologist, however, remained firm in his convictions.

"Stürmer believed his theory until he died, filled with bitterness in 1986," Schoenemann said. After nearly half a century, Schoenemann and her team feel they have finally vindicated his work.

Sadly, like Wilhelm Stürmer, phacopid trilobites are no longer with us — they went extinct about 358 million years ago at the end of the Devonian period, along with about 75% percent of all life on Earth, Schoenemann said. "But surely not because of their sophisticated, highly adapted eyes."

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https://www.livescience.com

Nearly 2,000 unknown chemicals found in vape liquids and e-cig aerosols

2021-10-11

A first-of-its-kind study from researchers at Johns Hopkins University has found traces of hundreds of unknown chemicals in electronic cigarette vaping liquid and aerosols. The study details a huge array of unidentified chemicals, plus a handful of known and potentially harmful compounds.

"Existing research that compared e-cigarettes with normal cigarettes found that cigarette contaminants are much lower in e-cigarettes,"

["]More and more young people are using these e-cigarettes and they need to know what they're being exposed to."

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explains senior author on the study, Carsten Prasse. "The problem is that e-cigarette aerosols contain other completely uncharacterized chemicals that might have health risks that we don't yet know about. More and more young people are using these e-cigarettes and they need to know what they're being exposed to."

The research is the first to conduct a thorough non-targeted analysis of all potential compounds present in vape liquids and aerosols using liquid chromatography/high-resolution mass spectrometry. Four popular tobacco-flavored vape liquids were tested, alongside testing of aerosols generated by four common electronic cigarette devices (one tank, one disposable, and two pods).

Almost 2,000 different chemical compounds were identified in the study and most of those compounds were unidentified. Six potentially harmful compounds were detected, out of the chemicals the researchers were able to identify. These included a pair of flavorings linked to respiratory irritation, three industrial chemicals, a pesticide, and perhaps most unusual – caffeine.

Mina Tehrani, lead author on the study, says two of the four vape liquids contained caffeine. Flavors such as coffee or chocolate are known to contain traces of caffeine but only tobacco vape liquids were tested so Tehrani was surprised by this finding.

"That might be giving smokers an extra kick that is not disclosed," says Tehrani. "We wonder if they are adding it intentionally."

Another unexpected finding in the study was the detection of condensed hydrocarbon-like compounds in the vape aerosols. These compounds are typically produced during combustion, but were still produced during the vaping process.

A similar recent Australian study using gas chromatography/mass spectrometry to analyze the chemical composition of 65 vape liquids found every sample studied contained at least one kind of potentially harmful chemical. These included benzaldehyde, an airway irritant and trans-cinnamaldehyde, an immunosuppressive agent. The Australian research also found traces of nicotine in six of the vape liquids tested, despite them being clearly advertised as nicotine-free.

These studies are certainly not the first to find potentially harmful chemicals in electronic cigarette liquids. But it is important to note these studies are designed to look for any traces of chemicals. They are not

investigating whether the chemicals directly cause harm in the context of vaping, or whether they are present in large enough quantities to hypothetically cause harm in the first place.

Instead, Prasse says the research affirms just how little we know about the chemicals being used in electronic cigarettes. While his study makes no comparison between harm caused by vaping and smoking cigarettes, Prasse does stress electronic cigarettes should not be considered a "healthy" alternative to traditional smoking.

"People just need to know that they're inhaling a very complex mixture of chemicals when they vape. And for a lot of these compounds we have no idea what they actually are," says Prasse. "I have a problem with how vaping is being marketed as more healthy than smoking cigarettes. In my opinion we are just not at the point when we can really say that."

The new study was published in the journal Chemical Research in Toxicology.

Source: Johns Hopkins University

newatlas.com, 11 October 2021

https://www.newatlas.com

Maryland woman catches rare tropical bacterial disease from her fish tank

2021-10-09

A woman in Maryland contracted a rare bacterial disease from her home aquarium, according to a new report.

The disease, called melioidosis, is usually seen only in tropical areas outside of the U.S., and when cases do appear in the U.S., they almost always occur in people who have traveled to other countries. The Maryland case, which occurred in 2019 and is described in a report published Sept. 27 in the journal Emerging Infectious Diseases, is unusual because the woman had never traveled outside the U.S. Her case is also the first in the world to be connected to a home aquarium, the authors said.

Such non-travel-related cases of melioidosis are becoming more common, however. In August, U.S. health officials announced they were investigating four cases of melioidosis that occurred in 2021 and weren't tied to travel, Live Science previously reported. The sources of those

Such non-travel-related cases of melioidosis are becoming more common, however

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cases still haven't been identified, but officials suspect that an imported product — such as a food, drink, personal care item or cleaning product — may be the culprit. The Maryland case doesn't appear to be connected to the 2021 cluster.

Melioidosis is caused by the bacterium Burkholderia pseudomallei, which grows in tropical climates and is most commonly seen in Southeast Asia and northern Australia, according to the Centers for Disease Control and Prevention (CDC). People can become infected through contact with contaminated soil or water, particularly if they have cuts on their skin, the report said. People can also catch the disease by drinking contaminated water or inhaling contaminated dust or water droplets.

The disease can cause a range of symptoms depending on where the infection occurs in the body. Symptoms of a lung infection include cough, chest pain and high fever; symptoms of a skin infection include swelling and abscesses; and symptoms of a bloodstream infection include headache, abdominal pain and disorientation, according to the CDC. Not everyone infected with the bacteria experiences symptoms, but in those who do, the disease can be serious, with a fatality rate between 10% and 50%, according to a 2019 paper in the journal The Lancet Infectious Diseases. (Among the four U.S. melioidosis cases in 2021, two died.) Certain medical conditions, including diabetes and liver disease, can increase a person's risk of infection, according to the CDC.

The 56-year-old Maryland woman, who had a history of diabetes, was first hospitalized in September 2019 with fever, cough and chest pain, and tests showed she had pneumonia. Several days later, further testing revealed that she was infected with B. pseudomallei.

She began receiving an antibiotic called meropenem, which is recommended for treating melioidosis. After 11 days, she was well enough to leave the hospital. But three weeks later, her infection relapsed even though she was still on antibiotics. She was hospitalized for another week and given a second antibiotic. Overall, it took 12 weeks of continuous antibiotics to clear her infection.

To determine where her infection came from, health officials took samples from in and around the woman's home, including samples from her two freshwater aquariums. Samples from one fish tank were positive for B. pseudomallei, and the bacterial strain in the tank was a genetic match to the one that infected the patient.

The woman reported that she had purchased the aquariums, tank supplies and several types of tropical fish, including cherry barbs (Puntius titteya) and fancy-tailed guppies (Poecilia reticulata), in July 2019.

She also reported that she had put her bare hands and arms into the tank while cleaning it, the report said.

So officials investigated the pet store where the woman bought the fish, as well as the vendors that imported the fish, to check for B. pseudomallei contamination.

"Because these vendors might distribute freshwater animals and aquatic plants to pet store retailers throughout the United States, identifying possible source(s) of introduction with B. pseudomallei in the supply chain is essential to public health," the authors wrote in their report.

As a result of the case, the CDC is now including questions about ownership of aquariums and tropical fish in questionnaires used for investigating melioidosis cases, according to Gizmodo.

The case "really broadened our understanding about how the bacteria might be able to travel across borders through imported products. And now that we've identified this new route of exposure, that can raise awareness about this risk," study lead author Patrick Dawson, an epidemiologist in the Office of Science at the CDC, told Gizmodo.

To reduce the risk of catching diseases from fish in general, the CDC recommends that people wash their hands before and after cleaning aquariums and feeding fish. People should also wear gloves to cover any cuts on their hands while cleaning aquariums or handling fish, according to the agency.

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The fastest-spinning white dwarf ever seen rotates once every 25 seconds

2021-10-12

The sun turns once a month and the Earth once a day, but a white dwarf star 2,000 light-years away spins every 25 seconds, beating the old champ by five seconds. That makes it the fastest-spinning star of any sort ever seen — unless you consider such exotic objects as neutron stars and black holes, some of which spin even faster, to be stars (SN: 3/13/07).

About as small as Earth but roughly as massive as the sun, a white dwarf is extremely dense.

About as small as Earth but roughly as massive as the sun, a white dwarf is extremely dense. The star's surface gravity is so great that if you dropped a pebble from a height of a few feet, it would smash into the surface at thousands of miles per hour. The typical white dwarf takes hours or days to spin.

The fast-spinning white dwarf, named LAMOST J0240+1952 and located in the constellation Aries, got in a whirl because of its ongoing affair with a red dwarf star that revolves around it. Just as falling water makes a waterwheel turn, so gas falling from the red companion star made the white dwarf twirl.

The discovery occurred the night of August 7, when astronomer Ingrid Pelisoli of the University of Warwick in Coventry, England, and her colleagues detected a periodic blip of light from the dim duo. The blip repeated every 24.93 seconds, revealing the white dwarf star's record-breaking rotation period, the researchers report August 26 at arXiv.org.

The star's only known rival is an even faster-spinning object in orbit with the blue star HD 49798. But that rapid rotator's nature is unclear, with some recent studies saying it is likely a neutron star, not a white dwarf.

sciencenews.org, 12 October 2021

https://www.livescience.org

Elk finally liberated from car tire stuck around its neck for 2 years

2021-10-14

A bull elk in Colorado is finally free of a rubber tire that had been stuck around the animal's neck for over two years. On Saturday (Oct. 9), officers from Colorado Parks and Wildlife (CPW) removed the hefty accessory (along with the elk's antlers).

Rangers first spotted the 4.5-year-old elk, which weighs around 600 pounds (272 kilograms), during a wildlife survey of the Mount Evans Wilderness in July 2019. Several attempts had been made to capture the bull since then, but it always managed to evade officers.

"It was tight removing it [the tire]," Scott Murdoch, a wildlife officer at CPW who aided in the operation, said in a CPW statement. "It was not easy for sure."

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CPW wildlife officers were finally able to bring down the elk with a tranquilizer dart and successfully remove the tire, after members of the public reported seeing it in the Pine Junction area.

"It was tight removing it [the tire]," Scott Murdoch, a wildlife officer at CPW who aided in the operation, said in a CPW statement. "It was not easy for sure."

Unfortunately, the officers also had to remove the elk's antlers to get the tire over its head, because a steel band inside the tire prevented the officers from cutting through it. Luckily, the elk was back on his feet just minutes after the antlers were removed and was in good health.

"We would have preferred to cut the tire and leave the antlers for his rutting activity, but the situation was dynamic and we had to just get the tire off in any way possible," Murdoch said.

Elk (Cervus canadensis) use their antlers during rutting, a type of antler-locked wrestling, to establish dominance over other males and gain mating rights with a harem of females. Males grow a new set of antlers every year before the breeding season, so removing the antlers means this bull is likely to remain mate-less this year, but it will get another chance next year.

The elk either got the tire stuck when it was young and before it had any antlers, or during the winter after it had shed them. The most likely scenario is that the animal put its head in a tall stack of tires left abandoned somewhere and picked one up by accident, according to the statement.

The officers believe that the elk shed around 35 pounds (16 kg) after losing both its antlers and the tire, which was full of pine needles and dirt that added additional weight, according to the statement.

The officers feared that the elk may have sustained significant damage after lugging the heavy tire around its neck, but after removing the rubber ring, they were surprised to find little to no damage. "The hair was rubbed off a little bit, and there was one small open wound maybe the size of a nickel or quarter, but other than that it looked really good," Murdoch said. "I was actually quite shocked to see how good it looked."

Close-up video footage of the elk captured by a camera trap in 2020 and shared on CPW's Twitter page also suggests that the tire may only have been a minor inconvenience to the bull as he nonchalantly strolled through the woods.

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CPW officers had previously tried many times to catch the elk since it was first spotted. Between May and June, four unsuccessful attempts were made to capture the elusive elk but officers were unable to get a clean shot. The elk was also spotted three times on camera traps in 2020 but was never located, according to the statement.

While this case is shocking, animals in Colorado getting caught in human-made items is nothing new. CPW officers have also witnessed deer, moose, bears and other wildlife that have become entangled in a number of human-made obstacles, including swing sets, hammocks, clothing lines, decorative lighting, furniture, tomato cages, chicken feeders, laundry baskets, soccer goals and volleyball nets, according to the statement.

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https://www.livescience.com

Synthetic chemical in consumer products linked to early death, study finds

2021-10-12

Synthetic chemicals called phthalates, found in hundreds of consumer products such as food storage containers, shampoo, makeup, perfume and children's toys, may contribute to some 91,000 to 107,000 premature deaths a year among people ages 55 to 64 in the United States, a new study found.

People with the highest levels of phthalates had a greater risk of death from any cause, especially cardiovascular mortality, according to the study published Tuesday in the peer-reviewed journal Environmental Pollution.

The study estimated those deaths could cost the US about $40 to $47 billion each year in lost economic productivity.

"This study adds to the growing data base on the impact of plastics on the human body and bolsters public health and business cases for reducing or eliminating the use of plastics," said lead author Dr. Leonardo Trasande, a professor of pediatrics, environmental medicine and population health at NYU Langone Health in New York City.

Phthalates are known to interfere with the body's mechanism for hormone production, known as the endocrine system, and they are "linked with

Even small hormonal disruptions can cause "significant developmental and biological effects," the NIEHS states.

developmental, reproductive, brain, immune, and other problems," according to the National Institute of Environmental Health Sciences.

Even small hormonal disruptions can cause "significant developmental and biological effects," the NIEHS states.

Prior research has connected phthalates with reproductive problems, such as genital malformations and undescended testes in baby boys and lower sperm counts and testosterone levels in adult males. Previous studies have also linked phthalates to childhood obesity, asthma, cardiovascular issues and cancer.

"These chemicals have a rap sheet," said Trasande, who also directs NYU Langone's Center for the Investigation of Environmental Hazards. "And the fact of the matter is that when you look at the entire body of evidence, it provides a haunting pattern of concern."

The American Chemistry Council, which represents the US chemical, plastics and chlorine industries, shared this statement with CNN via email:

"Much of the content within Trasande et al's latest study is demonstrably inaccurate," wrote Eileen Conneely, ACC's senior director of chemical products and technology.

She added the study lumped all phthalates into one group and failed to mention that the industry says high-molecular-weight phthalates like DINP and DIDP have lower toxicity than other phthalates.

"Studies such as these fail to consider all phthalates individually and consistently ignore or downplay the existence of science-based, authoritative conclusions regarding the safety of high molecular weight phthalates," Conneely wrote.

'Everywhere chemicals'

Often called "everywhere chemicals" because they are so common, phthalates are added to consumer products such as PVC plumbing, vinyl flooring, rain- and stain-resistant products, medical tubing, garden hoses, and some children's toys to make the plastic more flexible and harder to break.

Other common exposures come from the use of phthalates in food packaging, detergents, clothing, furniture and automotive plastics. Phthalates are also added to personal care items such as shampoo, soap, hair spray and cosmetics to make fragrances last longer.

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People are exposed when they breathe contaminated air or eat or drink foods that came into contact with the plastic, according to the US Centers for Disease Control and Prevention.

"Children crawl around and touch many things, then put their hands in their mouths. Because of that hand-to-mouth behavior, phthalate particles in dust might be a greater risk for children than for adults," the CDC states.

'A snapshot in time'

The new study measured the urine concentration of phthalates in more than 5,000 adults between the ages of 55 and 64 and compared those levels to the risk of early death over an average of 10 years, Trasande said.

Researchers controlled for preexisting heart disease, diabetes, cancer and other common conditions, poor eating habits, physical activity and body mass, and levels of other known hormone disruptors such as bisphenol A or BPA, he said.

"However, I'm never going to tell you this is a definitive study," Trasande told CNN. "It is a snapshot in time and can only show an association."

Learning exactly how phthalates may affect the body requires a gold-standard double-blinded randomized clinical trial, he said. Yet such a study will never be done, he added, "because we cannot ethically randomize people to be exposed to potentially toxic chemicals."

"But we already know phthalates mess with the male sex hormone, testosterone, which is a predictor of adult cardiovascular disease. And we already know that these exposures can contribute to multiple conditions associated with mortality, such as obesity and diabetes," Trasande said.

The chemical BPA has also been linked to abnormalities in male babies' reproductive systems and later infertility issues in adult men, as well as obesity, heart disease, cancer and premature death from any cause. The synthetic compound was formerly found in most baby bottles, sippy cups and infant formula containers until parents boycotted those products over a decade ago. The FDA banned the chemical's use in bottles and sippy cups in 2012.

It is possible to minimize your exposure to phthalates and other endocrine disruptors like BPA, which can still be found in the linings of canned goods and paper receipts, Trasande said.

"First, avoid plastics as much as you can. Never put plastic containers in the microwave or dishwasher, where the heat can break down the linings so

they might be absorbed more readily," he suggested. "In addition, cooking at home and reducing your use of processed foods can reduce the levels of the chemical exposures you come in contact with."

Here are other tips to reduce you and your family's exposure:

- Use unscented lotions and laundry detergents.
- Use cleaning supplies without scents.
- Use glass, stainless steel, ceramic or wood to hold and store foods.
- Buy fresh or frozen fruits and vegetables instead of canned and processed versions.
- Encourage frequent hand washing to remove chemicals from hands.
- Avoid air fresheners and all plastics labeled as No. 3, No. 6 and No. 7

edition.cnn.com, 12 October 2021

https://www.edition.ccn.com

What if the universe had no beginning?

2021-10-12

In the beginning, there was … well, maybe there was no beginning. Perhaps our universe has always existed — and a new theory of quantum gravity reveals how that could work.

"Reality has so many things that most people would associate with sci-fi or even fantasy," said Bruno Bento, a physicist who studies the nature of time at the University of Liverpool in the U.K.

In his work, he employed a new theory of quantum gravity, called causal set theory, in which space and time are broken down into discrete chunks of space-time. At some level, there's a fundamental unit of space-time, according to this theory.

Bento and his collaborators used this causal-set approach to explore the beginning of the universe. They found that it's possible that the universe had no beginning — that it has always existed into the infinite past and only recently evolved into what we call the Big Bang.

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A quantum of gravity

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Quantum gravity is perhaps the most frustrating problem facing modern physics. We have two extraordinarily effective theories of the universe: quantum physics and general relativity. Quantum physics has produced a successful description of three of the four fundamental forces of nature (electromagnetism, the weak force and the strong force) down to microscopic scales. General relativity, on the other hand, is the most powerful and complete description of gravity ever devised.

But for all its strengths, general relativity is incomplete. In at least two specific places in the universe, the math of general relativity simply breaks down, failing to produce reliable results: in the centers of black holes and at the beginning of the universe. These regions are called "singularities," which are spots in space-time where our current laws of physics crumble, and they are mathematical warning signs that the theory of general relativity is tripping over itself. Within both of these singularities, gravity becomes incredibly strong at very tiny length scales.

As such, to solve the mysteries of the singularities, physicists need a microscopic description of strong gravity, also called a quantum theory of gravity. There are lots of contenders out there, including string theory and loop quantum gravity.

And there's another approach that completely rewrites our understanding of space and time.

Causal set theory

In all current theories of physics, space and time are continuous. They form a smooth fabric that underlies all of reality. In such a continuous space-time, two points can be as close to each other in space as possible, and two events can occur as close in time to each other as possible.

"Reality has so many things that most people would associate with sci-fi or even fantasy."

Bruno Bento

But another approach, called causal set theory, reimagines space-time as a series of discrete chunks, or space-time "atoms." This theory would place strict limits on how close events can be in space and time, since they can't be any closer than the size of the "atom."

For instance, if you're looking at your screen reading this, everything seems smooth and continuous. But if you were to look at the same screen through a magnifying glass, you might see the pixels that divide up the

"Reality has so many things that most people would associate with sci-fi or even fantasy," said Bruno Bento, a physicist who studies the nature of time at the University of Liverpool in the U.K.

space, and you'd find that it's impossible to bring two images on your screen closer than a single pixel.

This theory of physics excited Bento. "I was thrilled to find this theory, which not only tries to go as fundamental as possible — being an approach to quantum gravity and actually rethinking the notion of space-time itself — but which also gives a central role to time and what it physically means for time to pass, how physical your past really is and whether the future exists already or not," Bento told Live Science.

Beginning of time

Causal set theory has important implications for the nature of time.

"A huge part of the causal set philosophy is that the passage of time is something physical, that it should not be attributed to some emergent sort of illusion or to something that happens inside our brains that makes us think time passes; this passing is, in itself, a manifestation of the physical theory," Bento said. "So, in causal set theory, a causal set will grow one 'atom' at a time and get bigger and bigger."

The causal set approach neatly removes the problem of the Big Bang singularity because, in the theory, singularities can't exist. It's impossible for matter to compress down to infinitely tiny points — they can get no smaller than the size of a space-time atom.

So without a Big Bang singularity, what does the beginning of our universe look like? That's where Bento and his collaborator, Stav Zalel, a graduate student at Imperial College London, picked up the thread, exploring what causal set theory has to say about the initial moments of the universe. Their work appears in a paper published Sept. 24 to the preprint database arXiv. (The paper has yet to be published in a peer-reviewed scientific journal.)

The paper examined "whether a beginning must exist in the causal set approach," Bento said. "In the original causal set formulation and dynamics, classically speaking, a causal set grows from nothing into the universe we see today. In our work instead, there would be no Big Bang as a beginning, as the causal set would be infinite to the past, and so there's always something before."

Their work implies that the universe may have had no beginning — that it has simply always existed. What we perceive as the Big Bang may have been just a particular moment in the evolution of this always-existing causal set, not a true beginning.

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There's still a lot of work to be done, however. It's not clear yet if this no-beginning causal approach can allow for physical theories that we can work with to describe the complex evolution of the universe during the Big Bang.

"One can still ask whether this [causal set approach] can be interpreted in a 'reasonable' way, or what such dynamics physically means in a broader sense, but we showed that a framework is indeed possible," Bento said. "So at least mathematically, this can be done."

In other words, it's … a beginning.

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https://www.livescience.com

Reuniting the pack: it took 16 months and a journey through six cities to bring our dog Luna home

2021-10-05

In the drab uncertainty of Sydney's lockdown, silver linings can be hard to come by. But you never know. Ours arrived on our doorstep a few days ago in the form of a wet nose, an irrepressible appetite for walks and the uncanny ability to sniff out discarded food scraps at great distance. Enter Luna.

Luna is not a pandemic puppy and she is no lockdown stopgap. But we haven't seen her for a long time. Sixteen months to be exact.

We moved to Washington DC early in 2016, when Barack Obama was president and the world still seemed to spin on a predictable axis. The first few months adjusting to a new country were tough; my middle child missed her friends and bawled her eyes out almost every night, convinced that she would never be able to feel at home in the US without a dog. She made it sound like an ultimatum. We succumbed.

We found a rescue – a feisty, one-year-old, jack russell-beagle mix with soulful brown eyes and a rough past on the backroads of South Carolina. Luna came home with us on a summer evening bright with fireflies, and we never looked back. Every day after dropping my daughter off at our local elementary school, I walked Luna at the nearby dog park. It was there I met a motley crew of other mutt-loving mums who would become my best friends and rock-solid community throughout our posting. With Luna by our side, we survived the Trump years, explored our new home, and had the adventure of our lives.

The end of our time in the US coincided with the unleashing of Covid. Kids stopped going to school and everything closed down. We hoped it would all be over in a few months, but there was dread in the air. Not knowing whether we would have to shelter in place or return to the motherland made our imminent departure even more stressful. Luna had been through months of vet visits to comply with Australian requirements and was booked on a plane so that we could retrieve her soon after our arrival.

That was not to be. Mere days before our departure we got the phone call saying that all pet travel on flights had been cancelled.

We were gutted.

Our children were beyond distraught. Who could take Luna? Would we have to let her go … for ever? We seemed at a dead end. Unbelievably,

But we haven't seen her for a long time. Sixteen months to be exact.

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our DC community, those dog-park mums, came to the rescue, generously offering to look after Luna for as long as it would take. We figured a couple of months. We were way off.

I remember our last walk with Luna; the sense of disbelief, the city awash with April cherry blossoms. Leaving our adopted home during Covid was unnatural and disassociating. There were no farewell parties, no last, loving hugs. The primary emotion was a sort of numbness, shot through with moments of sudden grief. I remember standing in our garden with Luna and our friends at a distance as they offered parting pandemic gifts: plastic gloves and hand-sewn face masks. Our eyes reached for each other but our arms could not.

Unable to say a proper goodbye to the city or our friends, our departure felt open-ended. We left Luna behind, and with her a part of ourselves.

After quarantining in Sydney, we had to find a place to live and schools for our three kids, so we patched up the hole as best we could and fell to the work of settling in. As time passed, we started believing that maybe we weren't so attached to her. And anyway, there seemed to be no easy way to get her back. Only our youngest kept crying bitter tears, longing to be reunited with her dog. The rest of us surrendered to reality. We thought the distance would temper our fondness. We were wrong.

When the bureaucratic wheels of her return finally started turning, the excitement began to bubble up again, but there were also nerves. Would she recognise us? Would it all work out?

On the day of her departure, a blistering heatwave hit DC and the airline would not risk taking her as cargo. The pet company drove her to New York instead, but the traffic was so bad, she missed her flight. And so began Luna's odyssey, including a stay in a tatty New Jersey cargo hold until she boarded a plane bound for Los Angeles, a week in its urban airport pet lounge with multiple carers, a long-haul flight to Singapore for another stayover, before she finally arrived in Melbourne for her obligatory 10-day quarantine. We wondered what state we would find her in after such a journey. We counted down the days and readied ourselves for an epic family reunion drive.

And then, boom, lockdown two! We were trapped in Sydney days before Luna's release from quarantine. We couldn't believe it. It all seemed doomed. Family in Melbourne were able to retrieve her and kindly took her in. Luna had made it safely across the ocean but could she cross the state lockdown divide? I harboured illicit fantasies of breaking her out of

Melbourne, but eventually discovered a pet transport company that could do it legally.

The van arrived outside our house on a warm and breezy Sydney day and as soon as the doors slid open and she caught our scent from her crate, she started to make little moans of recognition. After all this time, she still knew who we were. She all but knocked us over with a tail that did not stop wagging while we lavished her with love. Right there and then, my son promised her we would never leave her again.

With Luna home, lockdown life has changed. We feel more energised, the world seems broader. She has literally grown the love in our home. Our sullen teens make multiple daily declarations of adoration as they bury their faces into her warm body. And our youngest finally has a playmate again – you can feel the joy bouncing back into her. I, too, appreciate Luna's comforting presence in ways that I didn't foresee before lockdown and let myself forget while she was away.

She hasn't just come home to us, we have come home through her. She closed a circle of unsaid goodbyes and carried with her the imprint of friends and loved ones far away, who took her in. Her odyssey through pandemic and lockdowns and quarantines, through fire and flood, far from the place she knew, was also ours.

A few hours after the initial tumult and excitement of Luna's return had subsided, I spied my eight-year-old daughter deeply ensconced on the couch with her long-lost dog and asked how she felt. Without skipping a beat, she patted Luna's head, looked me in the eye and said: "I feel complete. The pack is back together."

theguardian.com, 5 October 2021

https://www.theguardian.com

Mysterious Mexican mangrove forest is 'trapped in time' hundreds of miles from the coast

2021-10-08

Scientists have uncovered the origin of a mysterious landlocked mangrove forest in the heart of Mexico's Yucatán Peninsula.

Normally, trees of this species — known as red mangroves, or Rhizophora mangle — grow only in salt water, along tropical coastlines. But this forest is located near the San Pedro River in the state of Tabasco, more than 125 miles (200 kilometers) from the nearest ocean. Somehow, these

Exactly how this ecological enigma came about has baffled scientists.

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mangroves have adapted to live exclusively in this freshwater environment in southeast Mexico.

Exactly how this ecological enigma came about has baffled scientists. But now, an international, multidisciplinary team of researchers has revealed that this out-of-place ecosystem began growing around 125,000 years ago, when sea levels were much higher and the ocean covered most of the region.PLAY SOUND

"The most amazing part of this study is that we were able to examine a mangrove ecosystem that has been trapped in time for more than 100,000 years," lead author Octavio Aburto-Oropeza, a marine ecologist at the Scripps Institution of Oceanography at the University of California, San Diego, said in a statement. It was like putting together a "lost world," he added.

How did it get there?

Researchers began studying the San Pedro mangrove system only recently, but local people have enjoyed the unique ecosystem for generations.

"I used to fish here and play on these mangroves as a kid, but we never knew precisely how they got there," co-author Carlos Burelo, a botanist at the Juárez Autonomous University of Tabasco in Mexico who grew up near the forest, said in the statement. "That was the driving question that brought the team together."

To find out how this coastal ecosystem ended up marooned so many miles from the coast in an alien environment, the researchers analyzed the DNA in the mangrove trees to see how different they were from other mangrove populations.

The mangroves' "genomes accumulate mutations every generation at a rate of about one in every 300 million letters of the genetic code, which will be passed on to future generations," Richard Nichols, an evolutionary geneticist at Queen Mary University of London who was not involved with the study, told Live Science. "By counting up the number of differences between two genomes it is possible to estimate the number of generations since those two genomes shared an ancestor."

This is one of the most accurate ways to date when two populations became isolated. "If two populations have become isolated from each other, the most recent common ancestors of the individuals from different populations must pre-date the period of isolation," Nichols said.

Based on the number of genetic mutations accumulated in the mangroves' DNA, the team determined that the mangroves have been isolated from the geographically closest coastal mangroves for around 125,000 years. Because global sea levels were much higher 125,000 years ago due to warmer atmospheric temperatures, the researchers suspect that the area was once a coastline.

Therefore, the mangrove forest likely took root while the ocean was higher and managed to survive after it receded to modern-day levels, leaving the coastal ecosystem trapped inland and forcing it to adapt to the freshwater conditions provided by the San Pedro River.

Changing sea levels

Global sea levels have risen and fallen many times throughout Earth's history, due, in part, to subtle changes in Earth's orbit around the sun that cause the planet to receive more or less solar radiation, according to the National Oceanic and Atmospheric Administration (NOAA).

During periods in which Earth receives the least amount of radiation, known as glacial maximums or ice ages, the atmospheric temperature drops and ice sheets cover much larger areas in polar regions. When the planet receives the most amount of radiation, known as an interglacial period, the temperature rises and ice sheets melt, releasing more water into the oceans.

The last interglacial period ended around 120,000 years ago, according to NOAA, which lines up with the researchers' theory about the mangrove forest and rising sea levels.

However, previous models did not predict that sea levels at that time would be high enough to cover the mangrove forest — which is currently 30 feet (9 meters) above sea level.

The region surrounding the forest lies so low that a relatively small change in sea level can produce dramatic effects inland, so even though previous models only slightly underestimated the sea level rise, they massively underestimated how much of the region would have been submerged, according to the statement.

Researchers hope that findings could help predict how the region may be impacted by climate change induced sea level rises in the future."Studying these past adaptations will be very important for us to better understand future conditions in a changing climate," Aburto-Oropeza said.

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Ancient relict

The researchers described the San Pedro River mangrove forest as a "relict," an ecosystem that has survived from an earlier time period. And it wasn't just the mangroves that managed to survive — so did around 100 other species that thrived in or near the ancient ocean, including fish, turtles and plants, according to the statement.

"This discovery is extraordinary," co-author Felipe Zapata, a geneticist at the University of California, Los Angeles, said in the statement. "Not only are the red mangroves here with their origins printed in their DNA, but the whole coastal lagoon ecosystem of the last interglacial has found refuge here."

The researchers are not sure exactly how the mangroves and species that live among them were able to adapt to freshwater conditions, but other researchers can now use the site to investigate these questions. "There is certainly more to discover about how the many species in this ecosystem adapted throughout different environmental conditions over the past 100,000 years," Aburto-Oropeza said.

However, without protected status, the forest could be in danger. In the 1970s, a misguided development plan led large parts of the region to be affected by deforestation, and the mangroves only narrowly avoided destruction. But the forest is still very vulnerable to a similar situation in the future.

"We hope our results convince the government of Tabasco and Mexico's environmental administration of the need to protect this ecosystem," the researchers wrote in their paper. "The story of Pleistocene glacial cycles is written in the DNA of its plants, waiting for scientists to decipher it."

The study was published Oct. 4 in the journal Proceedings of the National Academy of Sciences.

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"People were once exposed once or twice in a lifetime," says Keith Bein, an atmospheric scientist at the University of California, Davis. "Now it's happening every summer and for longer."

How breathing in wildfire smoke affects the body

2021-09-16

For the more than seven million people in California's Bay Area living through historic wildfires, it's been hard to breathe for the past month. For

29 days the region has been under a "Spare the Air" alert, which means inhaling outdoor air presents a health hazard. Air quality is even worse in Oregon and Washington, and by this morning smoke had stretched all the way to the East Coast and even to Europe.

Wildfire smoke contains a variety of gases and particles from the materials that fuel the fire, including ozone, carbon monoxide, polycyclic aromatic compounds, nitrogen dioxide, and particulate matter—pollutants linked to respiratory and cardiovascular illnesses, according to a study in the Journal of the American Heart Association.

When a healthy person breathes in air tinged with smoke from the fires, they may feel a sting in their eyes, and when they cough, they may have trouble recovering their breath. But what happens to that same individual when they breathe smoky air for extended periods every year is still unclear.

"People were once exposed once or twice in a lifetime," says Keith Bein, an atmospheric scientist at the University of California, Davis. "Now it's happening every summer and for longer."

In the United States, air quality is measured on a color-coded scale known as the Air Quality Index (AQI), which was established in 1977 as part of the Clean Air Act. Stretching from 0 to 500, the AQI is split across six categories—from good to hazardous. Its scale measures the levels of five major pollutants: ground-level ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and particulate matter.

State and local agencies in cities with populations over 350,000 are required to report these levels daily. The pollutants are measured both by instruments on the ground and satellites that constantly collect information about what's in the atmosphere—including the particles from wildfires.

Impact on the human body

"We know pretty well it causes eye irritation, cough, wheezing—people with asthma are more likely to have an episode," says Irva Hertz-Picciotto, director of Environmental Health Sciences Core Center at the University of California, Davis.

"Wildfire smoke is a very complex type of air pollution," says Sarah Henderson, an environmental health scientist at the University of British Columbia. "It has many different gases in it, and the composition of those

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small particles can be highly variable, depending on what's burning [and] how hot it's burning."

Of particular concern, she says, is particulate matter 2.5 microns in diameter—also referred to as PM 2.5. Those small particles, and ones even smaller, are capable of penetrating deep into a person's lungs. Henderson says the body responds by releasing the same immune cells it would deploy to attack a virus. Unlike a virus, however, particulate matter isn't broken down by that immune response and results in long-lasting inflammation.

"That inflammation affects your lungs, kidneys, liver, and probably your brain," says Henderson.

Wildfires are a growing health threat—15 of California's 20 worst fires have occurred in the past 20 years, and Henderson says more evidence is needed to show exactly how wildfire smoke affects organs after long-term exposure.

"We don't have a clear understanding of what the health effects are on an unborn fetus, but systemic inflammation in a woman who is pregnant may affect her unborn baby," adds Henderson.

When wildfire smoke enters the airway, the tiny particles that it contains—which are about 30 times smaller than a human hair—can get lodged deep in the lungs and injure the lining. The body kicks into gear to dispel the foreign invaders, triggering spontaneous reflexes like coughing that helps cilia, the little hairs lining the cells of the airway, beat the particles out.

But the immune cells can't break down the particulate matter—which only makes them work harder to try to defeat it, resulting in even more inflammation, says Stephanie Christenson, assistant professor of pulmonology at University of California, San Francisco.

Inflammation can be a good thing for fighting off invaders. But Christenson says it's especially dangerous for anyone with underlying conditions such as asthma or COPD, both characterized by inflammation. Additional inflammation can exacerbate those diseases. "It's a really delicate balance before you can go overboard," she says.

With those diseases, it can be harder to get much-needed oxygen to the rest of the body. As oxygen enters the lungs it heads to the alveoli—tiny air sacs that form a thin barrier between the air and blood—and passes into the blood in the capillaries. When the body is fighting off a threat,

those air sacs can fill up with mucus so that air cannot pass through, Christenson says. This also makes it more difficult for the body to eliminate the carbon dioxide, which can also cause respiratory distress.

There's some evidence that the particles themselves can break through that barrier in the capillaries, getting into the bloodstream and causing an inflammatory response throughout the body.

While respiratory problems may be the most overt response to smoke inhalation, others are less obvious. In 2018, a study in the Journal of the American Heart Association found that smoke from the 2015 wildfires that scorched more than 893,000 acres of California was associated with cardiovascular issues and problems with blood flow to the brain in 361,087 emergency department visits between May 1 and September 30.

Karol Watson, professor of medicine/cardiology at the David Geffen School of Medicine at UCLA, links that to the proximity of the heart and coronary arteries to the lungs. Watson was part of a team that conducted a 2016 study published in The Lancet that looked at the effects of a variety of pollutants in six U.S. cities and discovered a link between high levels of air pollution and coronary disease.

Underlying conditions again are particularly worrisome when it comes to the damage wildfire smoke can inflict on the heart, Watson says. Heart attacks happen when the plaque building up in the arteries ruptures, and while Watson says researchers don't believe the particulate matter causes this buildup, it can destabilize existing plaque, causing it to rupture.

There's also some evidence that air pollution can trigger irregular heart rhythms, Watson says, although there's less known about why this might happen. It's especially difficult to study air pollution, she says, noting that her team's 2016 study required them to place monitors in households across the U.S.

"The trauma people go through may also affect their immune systems," says Hertz-Picciotto. "When you're driving with flames on both sides of your car, and your tires are melting and you're not sure you're going to make it out—definitely when you lose your entire home—the stress of rebuilding…I can see that playing a role in the massive amounts of stress on top of COVID."

Potential to worsen COVID-19

According to the Centers for Disease Control, exposure to wildfire smoke can prevent a person from fighting off respiratory diseases like COVID-19.

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"Higher air pollution is associated with respiratory effects and people being more prone to having respiratory illnesses," says Hertz-Picciotto. "To the extent that the immune system is compromised and cannot fight off viruses, air pollution exacerbates that."

One study recently published in the journal Environmental International found exposure to wildfire smoke in the summer correlated with three to five times more flu cases later in the year.

Tarik Benmarhia, an environmental health scientist from the University of California, San Diego, notes that the same populations of people who were more vulnerable to COVID-19—those with low incomes, pre existing conditions, and poor access to health care—may also be vulnerable to the impacts of wildfires.

A 2017 study in the American Journal of Epidemiology found that elderly Black people who are more likely to live in urban areas, where there is persistent air pollution, were more likely to be hospitalized from exposure to wildfire smoke.

Emerging threats in the suburbs

In addition to the health impacts, discovering exactly what people are breathing in is also an emerging concern among scientists.

Wildfire smoke was once primarily made of the earthy remains of fallen twigs, brush, and trees, but as wildfires increasingly blaze through suburbs, they're burning up the synthetic paints, carpets, and consumer goods that fill homes. In California's historic 2018 fires, 19,000 homes burned, compared to this year's 4,000 so far.

Bein says samples of wildfire smoke over the past five years show that for as many compounds in the smoke they can identify, there are even more that they can't.

"I don't think we've had resolution on the exposure side to see what all those chemicals are and what happens when they combust at very high temperatures," says Hertz-Picciotto, "nor do we understand how those health impacts might differ."

How to protect yourself

The CDC recommends staying indoors to avoid wildfire smoke.

HVAC systems can help purify air inside a home, as can air purifiers for a single room.

"If you have a room you can keep cool, close the windows, doors, then run a portable air cleaner with a HEPA filter," says Henderson.

It's important to not add to indoor pollution by cooking with gas, frying food, smoking, or even vacuuming, says the CDC. If forced to venture outside, the CDC also recommends wearing an N95 respirator tightly fitted to your face: COVID-19 surgical masks and other homemade face coverings won't protect you from the smoke.

"At the end of the day there's only so much you can do," says Bein, emphasizing that long-term planning must attempt to mitigate the kinds of fires currently plaguing Californians. New policies around prescribed burns as well as where homes can be built and what sort of features those homes should come with are solutions stakeholders need to tackle, Bein says.

"I think that's going to be one of humanity's greatest challenges," he says. "Not just wildfires but all the extreme events resulting from climate change. We are entering a new phase of reality we just can't reverse."

nationalgeographic.com, 16 September 2021

https://www.nationalgeographic.com

What does a cute space robot know about climate change? A lot, actually

2021-10-06

One afternoon last summer, as the worst wildfires in Oregon's history raged outside, my toddler and I sat down to watch Wall-E, the 2008 animated film about the last robot left on Earth, who is trying to clean all the garbage off the planet so humans can return home.

We don't normally watch TV in the afternoons, but this was an act of desperation. We hadn't been able to go outside for over four days. At the time, the air quality in Portland was the worst in the world. I had sealed our windows with duct tape, but the entire house still reeked of smoke. The sky was orange and dim; ash rained down like snowflakes. With that scene outside, we sat in the house spellbound, watching a cheerful robot dance to show tunes while wearing a garbage can lid as a hat and battling an animated apocalypse on the screen.

Wall-E wasn't the only film we watched during that endless week. We also watched Ice Age: The Meltdown, where a group of prehistoric animals try to escape massive flooding due to global warming. We sang our way

If you're going to talk about climate change in children's films, the first major entry into the genre was The Land Before Time, released in 1988.

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through Rio, a film about the last two blue macaws attempting to save their species from extinction, and Rio 2, where the macaws fight against logging in the Amazon. We watched Dinosaur, about a herd of dinosaurs hunting for food and water after a meteor destroys their ecosystem. After about the eighth movie, I realized that what we were actually watching was one long, animated exploration of climate change. Even while global warming has been ignored and mishandled by much of Hollywood for decades, the destruction of our planet and decimation of our natural resources has been on our children's TV screens the whole time.

If you're going to talk about climate change in children's films, the first major entry into the genre was The Land Before Time, released in 1988. An epic journey following a herd of dinosaurs searching for "a land of green, of leaves, of life," The Land Before Time is considered one of the greatest animated films ever made. It is also one of the first clear images of climate change in a children's film (albeit not human-caused climate change). As Roger Ebert described it, "The climate has changed. And so these peaceful vegetarians head west, seeking a fabled green valley where they hope to find food ... all but the last scenes take place in a blasted heath of red skies. Parched land. Withered trees. Barren wastes and thorn thickets."

"KIDS ARE SMARTER THAN MOST PEOPLE THINK."

Stu Krieger, the scriptwriter behind The Land Before Time, says that while the movie wasn't a direct reaction to climate change, it did intentionally address the need to preserve the planet's resources. "The dinosaurs' desire to make their way to a greener, more fertile place was a conscious theme from the start," Krieger explains. Perhaps the most impactful choice that Krieger made was to "talk up" to kids about tough subjects. "Kids are smarter than most people think," he says.

While The Land Before Time was paving the way for ugly realities on the big screen, an Australian filmmaker couple named Wayne and Diana Young was dreaming of making a movie that would tackle head-on the environmental degradation they were seeing all around them. "Our generation was not educated [about climate change] at all," Wayne Young says. "We couldn't call it an environmental film. We called it a fairy tale."

It's true that very few people were talking about climate change back then, but that's not because they didn't know about it. Even as Wayne and Diana were creating a fairy tale that would make every child want to fight for the natural world, Exxon scientists were researching climate change. "We made a prediction in 1980 of what the atmospheric warming would be from fossil fuel burning in 2020," Dr. Martin Hoffert, one of the leading

researchers consulting with Exxon, told me in June. "We predicted that it would be about 1 degree Celsius. And it is about 1 degree Celsius."

Instead of using that information to start looking into alternative energy sources, Exxon shut down its research projects and started funding climate deniers instead. In 1985, British scientists discovered a hole in the ozone layer over Antarctica and linked it to chlorofluorocarbons, or CFCs, which prompted a multinational agreement to cut down on the harmful chemicals and put pressure on companies like Exxon to abide. Then, the particularly scorching summer of 1988 led to a devastating drought that made climate change front-page news, prompting a high-level Exxon employee to develop the "Exxon Position" — which, per the Los Angeles Times, was to sow doubt about climate science in order to avoid more regulation. In 1989, the oil tanker Exxon Valdez spilled 11 million gallons of oil off the coast of Alaska, killing hundreds of thousands of birds, otters, seals, whales, and bald eagles. Climate change and environmental devastation were certainly happening — they just weren't part of the cultural conversation.

The Youngs wanted to change that. Enter 1992's FernGully, a story about a group of fairies and magical beings who live in a gorgeous, untouched rainforest, fighting against both humans who want to log their home and an evil creature named Hexus who takes the form of a dripping mountain of Valdez-like black sludge. "Originally he was named Exxon," Young tells Mic. "Eventually Fox said, 'You're going to have to change that character's name because Exxon is going to sue us and we're going to sue you.'"

It's hard to overstate the impact FernGully had on millennials. Young says he regularly hears from fans — now fully grown — who say that FernGully changed their lives, leading them into careers as marine biologists or scientists or environmentalists. In a 2018 interview, environment journalist Emily Guerin spoke about the impact FernGully's message had on her as a child: "Here's this beautiful lush landscape, and humans are messing it up."

Even if other films haven't been quite as direct, climate change has steadily crept its way into children's movies. The Japanese animated film Spirited Away (2002) explores human disregard for nature and the mismanagement of the planet's resources. Happy Feet (2006) addresses overfishing and pollution through dancing penguins, while Ice Age (2002, plus sequels in 2006, 2009, 2012, and 2016) follows a group of animals dealing with global warming. Police Patrol (2009) is about a car whose town is suffering from a drought and warming temperatures. The Lorax (2012) is an entire movie about a girl who wishes she could "see a real

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living tree" for the first time. Cars 2 (2011) is about Big Oil plotting to take over the world. Wall-E (2008), as we know, takes on consumerism and consumption. In recent years, the message is more blatant: 2016's Moana is a thinly veiled fable of greed and consumerism, while Frozen 2, released in 2019, is so clearly about climate change that a college professor uses it to teach his students.

And it's not just the quantity of children's films dealing with this theme. It's the way they do it. While the few Hollywood films that address climate change — who can forget Waterworld and Sharknado? — use it merely as a plot device, or focus on the world being saved through violence by some hypermasculine hero, these children's films focus on teamwork, connecting with nature, and respecting life-sustaining resources. It doesn't feel like a coincidence that the young people who grew up with these movies are now leading the fight for climate justice.

Part of what makes children's films the ideal playground to explore our resource crisis is the power of animation. Wall-E can give us a vivid image of what a desolate, trash-covered Earth will look like. Rio can introduce us to the Amazon rainforest and let us for a moment inhabit the overwhelming loneliness of being the last of your species, a situation facing 25% of animals and plants between now and 2050.

And animals themselves are likely another reason that environmental degradation is so frequently shown in children's films. Kids love animals, and if there is any go-to plot device that concerns animals, it's climate and extinction. In this way, perhaps the films our children watch will become a kind of animated tomb, a way to preserve the animal species that are rapidly disappearing from the face of the earth. When the blue macaw, the bird featured in Rio, went extinct only seven years after Rio was released, one article remarked that "children for generations to come will still be able to derive joy from their unique beauty — albeit in animated form."

Of course, not everybody thinks bringing climate change into children's films is a good thing. Glenn Beck, for example, called Happy Feet "propaganda," saying it was an "animated version of An Inconvenient Truth." A 2011 Fox News article argued that "films are now too focused on fueling young, impressionable minds with political arguments." But after watching Where the Wild Things Are, the movie critic A.O. Scott made this argument: "Bright colors, easy lessons, and thrilling rides that end safely and predictably on terra firma have their place. But so, surely, do representations of the grimmer, thornier thickets of experience. That's

what art is, and surely our children deserve some of that too. Which includes movies that elicit displeasure and argument along with rapture."

Perhaps the real danger isn't that these films show the grimmer, thornier thickets of climate change, but that they show all that, and then deliver a happy ending. (At the end of Wall-E, humans and robots return to Earth, with new plants growing out of the wasteland.) Meanwhile, our offscreen happy ending is officially on the cutting room floor. When Miyazaki, the creator of Spirited Away, made his 2019 film Weathering With You, about a girl who can control the weather, he supposedly refused to write a happy ending, explaining that he couldn't bring himself "to have a hero save the world, when the real world is already past saving."

But when I spoke with Wayne Young, the filmmaker behind FernGully, he said that the happy ending isn't a way of avoiding the realities of climate change, but a more subtle message about the potential of our species. "We might as well give children trust in the nature of the human spirit," Young says. Besides, he adds, if the future is going to happen, it belongs to the children, so we should encourage them to imagine a more beautiful, sustainable world than the one we've left them. "Leave the doors and the windows open for the child to become self-aware and work out where they fit in," he says. "Because they're way smarter than we are."

mic.com, 6 October 2021

https://www.mic.com

How catching birds bare-handed may hint at Neandertals' hunting tactics

2021-10-08

Juan Negro crouched in the shadows just outside a cave, wearing his headlamp. For a brief moment, he wasn't an ornithologist at the Spanish National Research Council's Doñana Biological Station in Seville. He was a Neandertal, intent on catching dinner. As he waited in the cold, dark hours of the night, crowlike birds called choughs entered the cave.

The "Neandertal" then stealthily snuck in and began the hunt.

This idea to role-play started with butchered bird bones. Piles of ancient tool- and tooth-nicked choughs bones have been found in the same caves that Neandertals frequented, evidence suggesting that the ancient hominids chowed down on the birds. But catching choughs is tricky. During the day, they fly far to feed on invertebrates, seeds and fruits. At night though, their behavior practically turns them into sitting ducks. The birds roost in groups and often return to the same spot, even if they've been disturbed or preyed on there before.

The "Neandertal" then stealthily snuck in and began the hunt.

So the question was, how might Neandertals have managed to catch these avian prey?

To find out, Negro and his colleagues decided to act like, well, Neandertals. Wielding bare hands along with butterfly nets and lamps — proxy for nets (SN: 04/09/20) and fire (SN: 2/20/14) that Neandertals may have had at hand— teams of two to 10 researchers silently snuck into caves and other spots across Spain, where the birds roost to see how many choughs they could catch.

Using flashes of light from flashlights to resemble fire, the "Neandertals" dazzled and confused the choughs. The birds typically fled into dead-end areas of the caves, where they could be easily caught, often bare-handed. Hunting expeditions at 70 sites snared more than 5,500 birds in all, the researchers report September 9 in Frontiers in Ecology and Evolution. The birds were then released unharmed. It was "the most exciting piece of research" Negro says he's ever done.

The results demonstrate that through teamwork, choughs can be captured without fancy tools at night and offer a likely way that Neandertals could have captured choughs. But actual Neandertal bird-catching behavior remains unknown. If this is in fact how Neandertals hunted, it adds to claims that their behavior and ability to think strategically is more sophisticated than they are often given credit for.

"The regular catchment of choughs by Neandertals implies a deep knowledge of the ecology of this species, a previous planning for its obtaining, including procurement techniques, and the ability to plan and anticipate dietary needs for the future," says Ruth Blasco. A taphonomist at the Catalan Institute of Human Paleoecology and Social Evolution in Tarragona, Spain, Blasco is an expert in Neandertal diet.

Such role playing, she notes, is "commonly used by scholars as valid analogies to infer processes that happened in the past." For instance, reenactments with replicas of wooden spears have suggested that Neandertals could have hurled the weapons to hunt prey at a distance (SN: 1/28/19).

The researchers re-creating chough hunts used butterfly nets to catch birds fleeing sites with narrow entrances, as well as bigger nets partially

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covering larger openings. But "the easiest thing was to grab the birds by hand," Negro says.

"You have to be intelligent to capture these animals, to process them, to roast and eat them," he notes. Previous studies have shown that Neandertals may have been similarly adept at foraging for seafood (SN: 3/26/20). "We tend to think that [Neandertals] were brutes with no intelligence," Negro says, "but in fact, the evidence is accumulating that they were very close to Homo sapiens."

sciencenews.org, 8 October 2021

https://www.sciencenews.org

The earliest evidence of tobacco use dates to over 12,000 years ago

2021-10-11

Ancient North Americans started using tobacco around 12,500 to 12,000 years ago, roughly 9,000 years before the oldest indications that they smoked the plant in pipes, a new study finds.

This discovery replaces the pipe-smoking report as the oldest direct evidence for the human use of tobacco anywhere in the world.

Excavations at the Wishbone site in Utah's Great Salt Lake Desert uncovered four charred seeds of wild tobacco plants in a small fireplace, say archaeologist Daron Duke of Far Western Anthropological Research Group in Henderson, Nev., and colleagues.

Those seeds, three of which the scientists radiocarbon dated, likely came from plants gathered on foothills or mountains located 13 kilometers or more from the Wishbone area, Duke's team reports October 11 in Nature Human Behavior.

The site was located in a sprawling marshland at the time of its occupation. Finds in and around the fireplace include bones of ducks and other waterfowl, a long, intact stone point and another point broken in two, a bone implement and seeds of several edible wetland plants.

It's unclear how ancient North American hunter-gatherers used the tobacco, Duke says. Wads of tobacco leaves, stems and other plant fibers may have been twisted into balls and chewed or sucked, with attached seeds spit out or discarded. Ancestors of Pueblo people in what's now

This discovery replaces the pipe-smoking report as the oldest direct evidence for the human use of tobacco anywhere in the world.

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Arizona chewed wild tobacco between around 1,000 and 2,000 years ago. Tobacco smoking can't be ruled out at the Wishbone site, Duke adds.

The earliest evidence of domesticated tobacco, which comes from South America, dates to only about 8,000 years ago (SN: 10/29/18). Duke suspects various ancient American populations independently tamed the plant at different times. "Certain groups wound up domesticating particular [tobacco] species, typically alongside food crops," he suggests.

sciencenews.org, 11 October 2021

https://www.sciencenews.org

Giant snails that were eating Florida homes finally eradicated…again

2021-10-13

Florida plays the unfortunate host to many invasive critters, from lionfish to Burmese pythons, but last week, officials announced that they had successfully eliminated a particularly slimy invader from the state: the formidable giant African land snail.

The kicker is, giant African land snails (Lissachatina fulica) invaded Florida once before, meaning this is now the second time the troublesome pests have been expunged from the state. This time around, the effort cost $24 million and required 10 years of work, The Miami Herald reported.

"There's still only one place on Earth where the giant African snail has been eradicated," Trevor Smith, director of the Florida Department of Agriculture and Consumer Services (FDACS) Division of Plant Industry, said at a news conference on Wednesday (Oct. 6). "It's right here, and now we've done it twice."

"This truly is an exciting day for our state and for our country," Florida Agriculture Commissioner Nikki Fried said, according to The South Florida Sun-Sentinel.

LAY SOUND

Why the elation? Giant African land snails can grow to be 8 inches (20.3 centimeters) long, and when they don't consume enough calcium from the soil, they begin munching through the stucco on houses instead, the Herald reported. The snails not only pose a threat to homes but also to Florida's agriculture industry, as they regularly gorge themselves on fruits

This time around, the effort cost $24 million and required 10 years of work, The Miami Herald reported.

and vegetables. And in the wake of their destruction, they squirt out a trail of smelly, stringy poop.

Some say the giant snails can give people and their pets meningitis, but that's technically true of all snails, Gizmodo reported in 2014. Snails can pick up a parasite named Angiostrongylus cantonensis from rat feces, if they consume it. And then if a dog then slurps up that snail in their backyard, or a human eats some snail meat stuck to an unwashed lettuce leaf, the parasite can sometimes reach the membranes of the brain and spinal cord, trigger an infection and cause swelling. Thankfully, the condition can be treated with antibiotics, but that doesn't make the thought of accidentally swallowing giant snail flesh any less gross.

The snails first arrived in South Florida in 1966, when a child brought three of the creatures to the area from Hawaii, where they're also invasive, the Sun-Sentinel reported. (The snails were initially imported as pets, and they may have also clung to cargo shipped from Africa, according to the National Invasive Species Information Center.) The child's grandmother reportedly released the snails into her backyard, and once released, the three snails multiplied and soon numbered in the thousands.

The state had quashed the invasion by 1975, but in 2011, a new wave of these snails suddenly surged. Smith said it's unclear exactly where the new snails came from, the Sun-Sentinel reported. That said, a recent state investigation suggested that, in 2010, a religious cult had snuck dozens of the snails into Florida from Nigeria for use in healing rituals, according to the Tampa Bay Times. But the snails may have also been imported unintentionally on cargo planes or ships, Fried said at the news conference.

After being spotted in Douglas Park near Coral Gables, Florida, in 2011, the monstrous snails soon spread across the rest of Miami-Dade County and parts of Broward County just to the north, according to the Herald. Over the past 10 years, researchers with the U.S. Department of Agriculture (USDA) and the state of Florida have studied the snails' biology, to come up with strategies to kill the slimy creatures; they also kept track of reported outbreaks across the state.

Since the start of the eradication effort, the team has collected and killed about 168,000 snails, the Herald reported.

The snails primarily come out at night and when it's raining, and they easily blend in with Florida foliage; when not out and about, the snails bury themselves under 6 to 8 inches (15 to 20 cm) of soil, making them

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even tougher to spot. So to find the pests, the state recruited two Labrador retrievers, Casie and Mellon, who trained for six months with the USDA to learn to sniff out the massive mollusks, according to the Herald.

The most recent sighting of a giant African land snail took place in 2017, meaning the species can now be considered eradicated in the state of Florida. Fingers crossed, it'll stay that way.

Read more about the giant snail infestation in the South Florida Sun-Sentinel and Miami Herald.

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Mysterious radio signals detected near centre of the Milky Way galaxy

2021-10-13

What suddenly gets bright in the sky, sends out random radio signals and then disappears for months?

It's a question that has stumped astronomers since the discovery of a mysterious radio signal coming from near the centre of our galaxy in January last year.

Key points:

- Astronomers have detected a strange radio signal seven times in nine months using the ASKAP telescope in WA
- The signal has also been detected by the MeerKAT telescope in South Africa
- The astronomers are not sure what caused the signal, but it may come from a rare group of mysterious objects

The signal is so strange it may be coming from a new type of celestial object, an international team of astronomers report in The Astrophysical Journal.

The team first picked up the signal while scanning the sky with the Australian Square Kilometre Array Pathfinder (ASKAP) radio telescope in outback Western Australia.

The signal is so strange it may be coming from a new type of celestial object, an international team of astronomers report in The Astrophysical Journal.

The signal appeared another four times in a row in just a couple of weeks, said study co-author Tara Murphy of the University of Sydney.

"That's when we were starting to think, 'OK, this is a real thing.'"

Then the signal from the source dubbed ASKAP J173608.2−321635 disappeared, reappearing a couple of times a few months later.

"Sometimes it seems to stay on, detectable for days or weeks at a time, and then other times it can come on and off in a single day, which is extremely fast for an astronomical object," Professor Murphy said.

Not only is the timing random, but the signal can vary in strength, becoming 100 times brighter in the radio spectrum.

The radio signal is highly polarised, vibrating in a single plane that rotates as it moves towards us. Supplied: University of Sydney/Sebastian Zentilomo(Gfycat)

Even more weirdly, the radio waves are aligned in one direction that rotates as the signal travels through the universe towards us.

"That rules out almost all astronomical objects we know of," Professor Murphy said.

But that doesn't mean we've suddenly detected aliens.

An astronomy detective story

In the months following the initial discovery, the team led by PhD student Ziteng Wang explored a number of options trying to work out what the source was.

"It's a bit like a detective story trying to rule out all these different possibilities," Professor Murphy said.

They narrowed it down to three.

The first option was a pulsar — the fast-spinning heart of a dead star, which regularly send out very fast pulses of energy like clockwork.

The team turned to the Parkes Radio Telescope, which is famous for detecting pulsars, but found nothing that could be the source.

So then they went to the MeerKAT radio telescope in South Africa, which can detect not only pulses, but take images of signals.

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They saw nothing for three months, but in February this year they detected a single signal that was almost as strong as the original signal, before fading away.

Even though the signal had some of the properties of a pulsar, there were no telltale fast pulses.

Space telescopes also found no objects emitting light in the X-ray and infrared ranges in the area that would indicate the source was a pulsar or another type of dead, fast-spinning star known as a magnetar.

The second possibility the team explored was whether the signal could have come from a massive flare from a star.

"This object was so bright that if it was a star, we should be able to see it in visible light," Professor Murphy said.

"But … we didn't see it at all, it was completely invisible.

"So then we've got this situation where we've ruled out the two most likely explanations."

Is it a 'cosmic burper'?

The only other possibility is that it belongs to a rag-tag group of rare objects known as galactic centre radio transients, one of which is dubbed the "cosmic burper".

"It could be that we've discovered one of these, so in a way that's exciting, because there are very few of them known, but also frustrating because we don't actually know what galactic centre radio transients actually are," Professor Murphy said.

Every single galactic centre radio transient that has been discovered is slightly different; while some emit regular pulses of radio waves, others don't.

"All of [this object's] properties are slightly different to all of the ones that are known, but the thing is they are all different to each other," Professor Murphy said.

So although they are all lumped in the same category, we don't know enough about them to tell if they are related at all.

"They all might just be unknown variable polarised objects near the centre of the galaxy," Professor Murphy said.

New radio telescopes unravelling mysteries of the universe

Transient objects are very hard to spot because they only turn on for a short amount of time, said Gemma Anderson, an astrophysicist at Curtin University and the International Centre for Radio Astronomy Research, who was not involved in the study.

"You want to hope your telescope is pointing at the right part of the sky when it is turning on, because it may not appear again for weeks, months or ever," Dr Anderson said.

And unlike transient objects that emit pulses of energy in the X-ray, optical or infrared wavelengths, objects that only emit radio waves are very difficult to detect.

But the advent of radio telescopes such as ASKAP Pathfinder and MeerKAT have enabled us to peer further into the universe than ever before.

"ASKAP is particularly powerful because it looks at such a large part of the sky in one go," Dr Anderson said.

"In Australia, we are now looking at the universe in a new way that hasn't been possible until now.

"This transient that this team has found is the tip of the iceberg."

The ASKAP and MeerKAT telescopes are the first stages of the world's largest radio telescope, the Square Kilometre Array (SKA).

When the SKA comes on board, it may be possible to find even fainter transient objects "of which there could be tens, hundreds, thousands of them in our galaxy that have remained hidden," Dr Anderson said.

Professor Murphy said she hoped the team would find more objects like this with the ASKAP telescope.

"Then by building up a statistical number of them, we'll be able to work out what they are.

"That's how things often happen in astronomy; you find one rare thing, then you find more like it and eventually you can actually understand what's going on."

abc.net.au, 13 October 2021

https://www.abc.net.au

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Did all roads lead to Rome?

2021-10-12

At the zenith of its control, the Roman Empire had a road network stretching from the sun-bathed Rock of Gibraltar to the marshlands of Mesopotamia. As the saying goes, "All roads lead to Rome" — but was that really the case?

The answer is not as easy as an unequivocal 'yes' or 'no.' It's a little more complicated than that.

In 2015, three researchers at the Moovel Lab — a now-defunct German urban design team — dropped a uniform grid of almost 500,000 points across a map of Europe. These points didn't represent ancient or modern cities, but were simply random spots from which to start a journey to the imperial capital. The team then used an algorithm to calculate the best route to Rome using modern routes from each of those starting points. The more frequently a segment of a road was used across the different points, the bolder it was drawn on the map. Their results showed a mesmerizing web of roads that led to Rome, connecting other major cities along the way, such as London, Constantinople (present-day Istanbul) and Paris, which were also part of the ancient empire. PLAY SOUND

As the saying goes, "All roads lead to Rome" — but was that really the case?

News of the map went viral, but it didn't actually prove that all roads lead to Rome. If the researchers had conducted the same exercise, but instead looked at the quickest way from those same 500,000 points to Berlin or Moscow, the map would show a similarly vast array of roads leading to those cities. "Our project didn't really answer the question whether all roads lead to Rome," said Philipp Schmitt, one of the designers behind the artwork. "It was a 99% playful exploration of the question."

Yet Schmitt's design still tells us something about the endurance of Roman roads: A lot of Europe's road infrastructure is still designed to link major cities to the Italian capital, potentially a legacy of the empire. Other researchers have also found this to be the case.

"We've used computer modeling to look at the most likely or most logical routes that connect two points on the landscape, and then compared that with our knowledge of Roman roads to see if they're similar," said César Parcero-Oubiña, a landscape archaeologist at the Institute of Heritage Sciences in Madrid, Spain. "Modern routes are often the same in most cases if you're going to and coming from places that were both also Roman cities."

In other words, many of Europe's multi-lane highways are the successors of Roman roads. This has changed in recent years, however, Parcero-Oubiña told Live Science. "Newly built motorways avoid populated places to save money in acquiring land, so that means some brand new motorways weren't always as logical as the old Roman routes."

And that brings us to the question at hand: What was the Roman logic for road building? Did all roads lead to Rome? "It depends on the importance of the road," Parcero-Oubiña said. "The logic of how an ancient empire works isn't so different to a modern country. The Romans weren't that different to us; they were just trying to minimize routes to save time."

The main roads were straight lines whenever geography allowed, and they connected important cities to other important cities, Parcero-Oubiña said. These direct routes were only possible once a country had been properly annexed by the Romans and any military opposition subdued, otherwise it wouldn't have been safe enough to travel in the open. In the early days following the acquisition of a province when barbarians, or non-Romans, were still resisting occupation, the Romans would stick to safer and less direct routes through dense woodlands or mountains in that province, Parcero-Oubiña said. Once a province was peaceful, however, these roads formed vital connections to speed up trade and keep the military on the frontline well supplied with troops and provisions.

"The main roads were connecting important places, and so, in one way or another, they all ended or started in Rome, but it's not like you had to go via Rome when traveling from London to Paris, because the network allowed for that to happen," Parcero-Oubiña said. These principal roads were designed for the movement of wheels and animals — in other words, they were far more sophisticated than muddy trails. "They were built with different layers like earth and rock, and then finally big slabs of stone on top. They weren't flat, but kind of dome shaped to allow proper drainage," Parcero-Oubiña said.

"The main roads were connecting important places, and so, in one way or another, they all ended or started in Rome, but it's not like you had to go via Rome when traveling from London to Paris, because the network allowed for that to happen," Parcero-Oubiña said. These principal roads were designed for the movement of wheels and animals — in other words, they were far more sophisticated than muddy trails. "They were built with different layers like earth and rock, and then finally big slabs of stone on top. They weren't flat, but kind of dome shaped to allow proper drainage," Parcero-Oubiña said.

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Then came other, secondary dirt roads that weren't paved. They connected smaller towns and cities, rather than offering any sort of a route to Rome.

So, did all Roman roads lead to Rome? No, but an awful lot of the important ones eventually made their way there. The premise of the question might be flawed anyway, said Parcero-Oubiña, because most people going to Rome weren't taking the roads.

"Connection via sea was much more useful because it was faster and cheaper," he said. "If you wanted to go from western Iberia to Rome, for example, then you probably took a boat and not a horse and cart."

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What are dust mites, why do they cause allergies and we can get rid of them?

2021-10-11

As the weather warms, it's time to open the windows and put away your winter woollies for another year.

If you're extra keen, you may even decide to do a deep clean in an attempt to wage war on one of life's annoying realities: dust mites.

These microscopic bugs can cause allergic reactions such as sneezing, wheezing and itching.

Just why some people get affected and others don't is still a mystery, and there are a lot of myths about how to control them.

So before you launch into your spring dust-busting mission, let's get down and dirty with the bugs themselves.

What are dust mites?

Dust mites are tiny arachnids, closely related to ticks.

Only around a third of a millimetre long, these white spider-like bugs are everywhere.

"You'll find them in carpets and beds and in your clothing, but as far as we know they don't live on your skin," says Euan Tovey of the Woolcock Institute of Medical Research, who studied dust mite allergies.

These microscopic bugs can cause allergic reactions such as sneezing, wheezing and itching.

Instead, they feast on dead skin cells, which make up a fair whack of house dust.

"When you wash your clothes, the reason the water goes cloudy is it's your skin cells floating around," Professor Tovey says.

"We shed about a teaspoon of skin a week."

What is dust and where does it come from?

As they munch away on the dead skin cells, the mites release enzymes in their gut that break the cells down.

In the 1980s, Professor Tovey discovered one of these enzymes is a powerful allergen that floats in the air on the mite's poo.

"That allergen from the poo becomes distributed onto smaller dust particles," Professor Tovey says.

"[These particles] go down to less than a millimetre, so it means they are inhalable."

People can also be allergic to a number of other proteins in the mite's body, but the enzyme accounts for about 60 per cent of allergies.

That's because a mite can produce a lot of poo over its lifetime of up to 90 days.

"A lifetime of poo is much more than a mite body, because they are continually producing poo."

Dust mite allergens can also hang around for a long time, depending on the level of humidity.

"In dry conditions it will hang around for years, under moist conditions it will break down in months."

Are some times of year worse than others?

The amount of mite allergen fluctuates through the year, depending upon the season.

"The growth conditions for mites is pretty ideal in spring because they like 25 degrees Celsius and pretty high humidity of around 75 per cent," Professor Tovey says.

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The hotter and more humid the weather, the better, but our homes provide the perfect environment for them to thrive all year round, even in arid areas.

"There are little wet places in houses, like the bottom layer of carpet is pretty damp, and beds have damp patches because of condensation ... so you'll get dust mites all the way out to Broken Hill," Professor Tovey says.

But even though dust mite numbers boom at this time of year, exposure to the allergen is greater during winter when your house is shut up.

Why are some people affected by dust mites and others aren't?

Dust mite allergens can cause conditions such as hay fever, eczema and asthma.

But the big question is why some people become allergic to mites and some people don't.

We used to think that the more exposure that someone had to mites, the worse their allergy, but that has turned out not to be the case, Professor Tovey says.

"There is a huge paradox about dust mite exposure," he says.

Nobody knows why some people are more allergic than others, says Wayne Thomas, of the Telethon Kids Institute, who has studied dust mite allergens.

Professor Thomas says some studies indicate that respiratory infections may trigger allergic reactions.

"It might be a matter of timing; whenever you get your big hit of dust mite allergen exposure compared to when you last had a [respiratory] infection could be important."

Bacteria in your gut may also influence whether you become allergic or not, he added.

Diagnosing dust mite allergies is tricky.

"The standard test that doctors like to do with the skin prick test is far too sensitive," Professor Thomas says.

What's in our household dust?

He estimates about 75 per cent of people who test positive to dust mites have very low levels of sensitivity, or are reacting to different factors in the environment.

But for people who are sensitive to dust mites, the news is not good.

"Our ability to treat it hasn't got much better in the past 30 years or so," Professor Thomas says.

Even though we've identified the main allergens, we still don't understand much about what they do in the human body, and why different people are allergic to different dust mite allergens.

"If we want to make a better treatment for therapy or [develop a vaccine], we have to use the allergens we think cause all the allergic response," he says.

Are some parts of the house worse than others?

We once thought that we mainly got exposed to dust mite allergen in bed, but experiments by Professor Tovey have shown we get exposed whenever we move.

"Any time you move, you're generating your own little personal cloud of dust."

Just like Pig Pen from Snoopy, you are surrounded by a cloud of dust when you move.(Gfycat)

The studies show that you stir up dust when you first get into bed, but that generally settles down until you roll over.

"If you're a restless sleeper you probably get more exposure," he says.

But you are also exposed during the day.

"It comes off your clothing, it comes off when you sit down on the sofa, and when you walk across the carpet."

And beware if you are planning to take clothes out of storage.

"They have probably the highest levels of allergen I've ever seen," Professor Tovey says.

"If you put them on or you shake them around, if you are a bit allergic to dust mites you can certainly develop some sniffing and sneezing."

What's the best way of reducing dust mite allergens?

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While you can never totally get rid of them, there's a few things you can do to lower your exposure.

The simplest thing is washing.

"Dust mite allergen is incredibly soluble, it dissolves like the click of your fingers," Professor Tovey says.

"Warm water is better than hot, detergent is better than not.

"If you use really hot water, which is really hard to do, you can kill the mites, but they'll still come back from somewhere else."

Keeping your home dry will also keep dust mite and allergen levels low.

Airing clothes and carpets in sunlight can also kill dust mites, but you won't get rid of the allergen unless you wash the items first.

Using a wet cloth to dust may help to reduce the allergen slightly.

Professor Tovey says vacuuming will also help to reduce allergen a little bit on surfaces, but "it's not great".

"There's still a lot that exists after you vacuum a floor pretty thoroughly, there's still a lot of material in the base of the carpet," he says.

There is little evidence to recommend special mattress encasings, as they don't stop dust mites in other areas.

"You can spend a vast amount of money on better vacuum cleaners and mattress encasings, but you can achieve a lot of that purpose just by regular washing," Professor Tovey says.

And forget the special sprays.

"Once you kill a few mites, some others are just going to replace them, so I would say it's a bit of a futile exercise," he says.

"Even if they do kill mites or destroy allergens a little bit, do they really make people better?

"I'm very confident there's no decent data showing that."

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[PI3K/Akt/mTOR signal pathway in endocrine disrupting chemicals-induced apoptosis and autophagy of thyroid follicular cells]

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