CHEMWATCH

Bulletin Board

Contents

SEP. 10, 2021

(click on page numbers for links)

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CHEMWATCH

Bulletin Board

Contents

SEP. 10, 2021

CURIOSITIES

TECHNICAL NOTES

ASIA PACIFIC

Consultation on proposed amendments to the General Rules

2021-08-27

What this is about

After the first year of operation of the AICIS, a number of minor operational issues have been identified which require amendments to the details set out in these Ministerial Rules. These issues have been identified both by the regulated industry and by staff within the Office of Chemical Safety (OCS) implementing the scheme.

We are proposing targeted amendments to the Industrial Chemicals (General Rules) 2019 and the Industrial Chemicals (Consequential Amendments and Transitional Provisions) Rules 2019 to clarify the operation of the Ministerial Rules within existing policy. The proposed amendments relate to the following matters:

- clarifying criteria for industrial chemicals introduced at the nanoscale
- declarations about data ownership
- annual declarations
- clarifying record-keeping for listed introductions, specified classes, designated releases to the environment, internationally-assessed
- the authorisation process for movement of industrial chemicals into or out of Australia that are subject to the Rotterdam Convention
- transitional provisions.

Read More

Australian Industrial Chemicals Introduction Scheme, 27 August 2021

https://www.industrialchemicals.gov.au/consultations/consultation-proposed-amendments-general-rules

These issues have been identified both by the regulated industry and by staff within the Office of Chemical Safety (OCS) implementing the scheme.

Annual declaration for all introducers

2021-08-27

At the end of every registration year, you'll need to provide certain information and confirm that your chemical introductions were authorised under our laws. We call this an 'annual declaration'.

What is an annual declaration

This is a declaration you make about the industrial chemicals you imported or manufactured during the previous registration year. It's an opportunity to confirm that your introductions were authorised under our laws.

You'll need to answer a few simple questions and complete a legal declaration via our online form.

Read More

Australian Industrial Chemicals Introduction Scheme, 27 August 2021

https://www.industrialchemicals.gov.au/business/reporting-and-record-keeping-obligations/annual-declaration-all-introducers

Japan MHLW consults on health hazard prevention measures for 235 substances

2021-08-20

235 hazardous substances are proposed to mandate SDS and labelling requirements under ISHL. More health hazard prevention measures will be imposed in the future.

Japanese Ministry of Health, Labor, and Welfare (MHLW) will listen to the views and feedback from stakeholders on the Implementation of Health Hazard Prevention Measures for 235 Substances Including 2-(dimethylamino)ethyl acrylate from 10:00 to 12:00 on August 30. Those who cannot participate on site can join online via Skype or Teams. The deadline for submitting comments is 12:00 on August 27.

Those who cannot participate on site can join online via Skype or Teams.

Read More

Chemlinked, 20 August 2021

https://chemical.chemlinked.com/news/chemical-news/japan-mhlw-consults-on-health-hazard-prevention-measures-for-235-substances

AMERICA

'Action is needed': Montreal unveils new bylaw banning pesticides

2021-08-19

Montreal will be the first municipality in North America to completely ban the sale of more than 100 pesticide products for domestic use, Mayor Valérie Plante announced Thursday.

"Montreal is the first city in the country to go this far," she added.

A bylaw to be adopted in September will bar the use of 36 substances, including the herbicide glyphosate, the active ingredient in Roundup. Also on the list is chlorpyrifos, used against insects and other pests, and some neonicotinoids, used in agriculture, pest control and to protect trees from invasive insects like the emerald ash borer.

The city will hire additional staff to enforce the bylaw, to come into effect in January 2022.

Plante said her administration was taking "concrete, unprecedented action … to offer citizens a healthy city."

Montreal Gazette, 19 August 2021

https://montrealgazette.com/news/local-news/montreal-unveils-new-bylaw-banning-pesticides

inside the deaces-long fight over an Ohio superfund site

2021-08-18

Thirty acres of desolate land stretch across the heart of Uniontown, Ohio, a vast expanse of grass, trees, and scruffy vegetation no one can use because a toxic stew of nearly one hundred deadly contaminants festers beneath its surface. Enclosed by chain-link fencing and warning signs, the Industrial Excess Landfill (IEL) is one of more than thirteen hundred hazardous Superfund sites on the Environmental Protection Agency's National Priorities List.

Thirty acres of desolate land stretch across the heart of Uniontown, Ohio, a vast expanse of grass, trees, and scruffy vegetation no one can use because a toxic stew of nearly one hundred deadly contaminants festers beneath its surface.

While open, IEL's broad swath of customers ranged from Akron City Hospital to the National Guard, but, according to the EPA, the waste came primarily from the rubber industry: Firestone, General Tire, Goodrich, and Goodyear in nearby Akron, the Rubber Capital of the World.

Read More

The Center for Public Integrity, 18 August 2021

https://publicintegrity.org/inequality-poverty-opportunity/workers-rights/worker-health-and-safety/ohio-superfund-site/

EUROPE

UK introducing regulation for nuclear shipping

2021-08-16

The UK has launched a consultation on proposed regulations for nuclear-powered ships that would enable UK-flagged vessels to use the power source and international vessels to visit its ports. "The UK is committed to enabling the adoption of new technologies that manufacturers and ship owners may choose to meet legal requirements relating to air pollution and greenhouse gas emissions, and therefore will establish a regulatory framework that will support nuclear-powered ships as an alternative fuel option," said the UK Maritime & Coastguard Agency (MCA).

Signatories to SOLAS are obligated to do this, but the UK has lagged behind by some 40 years by not matching the 1981 Nuclear Code.

To do this, MCA wants to create national legislation that mirrors provisions of the International Convention for the Safety of Life at Sea (SOLAS) and the International Maritime Organisation (IMO) *Code of Safety for Nuclear Merchant Ships* - also known as the *Nuclear Code* - that the convention refers to. Signatories to SOLAS are obligated to do this, but the UK has lagged behind by some 40 years by not matching the 1981 *Nuclear Code*.

Filling this "regulatory gap", as the MCA calls it, would install a ready-made suite of regulation providing for the construction and operation of UK ships using nuclear power, as well as for nuclear powered ships with flags of other countries visiting UK ports.

The proposed regulations would introduce a dedicated nuclear pre-commissioning test programme as well as surveys during the construction and trial phases for quality assurance and to verify a ship is built in line

with requirements. There would also be regular surveys of the nuclear portion of a ship during its operational life.

Read More

World Nuclear News, 16 August 2021

https://www.world-nuclear-news.org/Articles/UK-introducing-regulation-for-nuclear-shipping

INTERNATIONAL

Siberia's massive wildfires are unlocking extreme carbon pollution

2021-08-20

The North American West isn't the only place that's burning this summer. Thousands of miles away in Siberia, hot, dry weather has helped fuel widespread forest fires that are releasing giant plumes of smoke and hundreds of millions of tons of heat-trapping carbon dioxide into the atmosphere.

Residents of the region, many of them farmers, have been fighting the unprecedented fires themselves, even as they attempt to harvest what they can before wildfire consumes their crops.

Siberia may be better known for its frigid winters, but it's no stranger to summer wildfires. And for the past few summers, those fires have been exceptional, particularly in the Sakha Republic, a region of far northeastern Russia nearly double the size of Alaska. In 2020, Sakhan wildfires were more intense, and released more carbon between June and August, than at any other point in satellite records going back to 2003.

Siberia may be better known for its frigid winters, but it's no stranger to summer wildfires.

Read More

National Geographic, 20 August 2021

https://www.nationalgeographic.com/environment/article/siberias-massive-wildfires-are-unlocking-extreme-carbon-pollution

Fish and livelihoods poisoned by South African chemical spill

2021-08-19

No sooner had the looting stopped than fisherman Bobby Pillay gathered up his rod and bait, desperate to venture out of hiding and get back to the South African seafront.

What he found was devastation.

The beach glistened with poisoned fish, hundreds of them lying inert on the wet sand, slick with chemicals.

"I have never seen a thing like this," said 76-year-old Pillay from his home in Phoenix, a town north of central Durban that was badly hit by July's riots.

"This is devastating for us, on top of lockdown, this just adds fuel to the fire," he said, holding up a local news clipping about the spill.

The cull came after looters - believed to have been spurred on by the arrest of former president Jacob Zuma - set fire to a warehouse owned by India›s UPL Ltd. It took more than a week to control the blaze and stem the slew of chemicals that ran off from the firefighting into nearby uMhlanga estuary.

Read More

~sThomson Reuters Foundation, 19 August 2021

https://news.trust.org/item/20210819103259-6i27v/

Hazard prioritization of printing inks and adhesives substances

2021-08-13

Scientific study performs hazard prioritization on chemicals in printing inks and adhesives applied to plastic food packaging; uses publicly available "substances of concern" lists and an in silico tool; identifies 636 high and 1024 medium priority substances of which 696 ranked as "very high priority substances" by experts.

… identifies 636 high and 1024 medium priority substances of which 696 ranked as "very high priority substances" by experts.

In an article published online on August 9, 2021, in the peer-reviewed journal *Food Additives & Contaminants: Part A,* Edoardo Galbiati and colleagues from the NutriFOODchem Research Group, *Ghent University*, Belgium, reported on a hazard prioritization of chemicals used in printing inks and adhesives in plastic food contact materials (FCMs).

To prioritize hazardous substances, the researchers first compiled an inventory of chemicals intentionally used in printing inks and adhesives of plastic FCMs by reviewing scientific publications and regulatory documents including the Swiss Ordinance Annex 10 on materials and articles in contact with food. Subsequently, they performed several steps to exclude substances not considered relevant such as chemicals without a CAS number, chemicals with a molecular weight above 1000 Dalton, and according to selected criteria based on the Threshold of Toxicological Concern (TTC) concept. For the remaining chemicals, Galbiati et al. performed hazard prioritization by comparing them to the Candidate List of substances of very high concern (SVHC) for authorization under the REACH regulation (FPF reported), to the SIN list (FPF reported), the Rapid Alert System for Food and Feed (RASFF) portal, and a list of substances used in printed paper and board FCMs published by Van Bossuyt et al. (FPF reported). When toxicity data was absent or scarce, the scientists followed the TCC approach to predict the chemical's toxicity based on the chemicals' structural information and estimated exposure level. Any of the substances present on the SVHC or SIN lists, in Van Bossuyt et al., in a notification from the RASFF portal, or with a Structural Alert (S.A.) for genotoxic carcinogenicity were considered as high priority. Chemicals classified as Cramer Class III or a S.A. for non-genotoxic carcinogenicity were ranked as medium priority. High and medium priority substances were presented to five experts from industry and academia to gain their opinion whether the chemical is "relevant or not for further investigation with respect to its migration from inks and adhesives used in food contact materials."

Read More

Food Packaging Forum, 13 August 2021

https://www.foodpackagingforum.org/news/hazard-prioritization-of-printing-inks-and-adhesives-substances

An explosion in the use of fentanyl, a synthetic opioid 50 times more potent than heroin, and its analogues has driven the most devastating chapter of America's long-running opioid and drug abuse crises.

EXCLUSIVE Limited Chinese cooperation hindering U.S. fentanyl fight – congress report

2021-08-24

Weak cooperation between U.S. and Chinese authorities is hindering efforts to curb increasingly sophisticated forms of fentanyl trafficking, according to a U.S. congressional advisory report reviewed by Reuters.

The report by the U.S.-China Economic and Security Review Commission, due to be published on Tuesday, said U.S. authorities have found that cooperation with Chinese counterparts "remains limited on the ground".

An explosion in the use of fentanyl, a synthetic opioid 50 times more potent than heroin, and its analogues has driven the most devastating chapter of America's long-running opioid and drug abuse crises.

Combating fentanyl smuggling has become a key priority for U.S. agencies as overdose deaths spiked to more than 93,000 in 2020, mostly linked to fentanyl, according to provisional data by the National Center for Health Statistics.

Deaths surged by more than 21,000 to eclipse a record set a year earlier.

Despite China banning fentanyl and similar variants in 2019, the Asian nation remains the primary source of illicit fentanyl and fentanyl-related substances trafficked into the United States, the report said.

The accusations are unreasonable and unacceptable, said the Chinese foreign ministry when asked by Reuters to comment on the report.

China has strictly controlled all narcotics, psychotropic drugs and chemical precursors, and its efforts are recognised internationally, the ministry said.

Read More

Reuters, 24 August 2021

https://www.reuters.com/world/us/exclusive-limited-chinese-cooperation-hindering-us-fentanyl-fight-congress-2021-08-24/

UK REACH authorisation decisions

2021-08-17

The Secretary of State for the Department for Environment, Food and Rural Affairs (Defra), with the consent of Scottish and Welsh Ministers, has made a decision on a transitional application for authorisation, submitted by Ortho-Clinical Diagnostics, for the time-limited use of a substance of very high concern (SVHC) under UK REACH.

The Defra Secretary of State has granted authorisation to Ortho-Clinical Diagnostics for the following use of a substance:

- Formulation of 4-(1,1,3,3-Tetramethylbutyl) phenol, ethoxylated (Triton X-100) for use in the manufacture of in vitro diagnostic VITROS® products used for infectious disease screening, endocrinology, and oncology testing.

This authorisation decision was made under Article 127G which relates to a transitional measure of UK REACH.

This authorisation decision was made under Article 127G which relates to a transitional measure of UK REACH.=

Transitional applications received by the Defra Secretary of State are published on GOV.UK.

Decisions made by the Defra Secretary of State are published on GOV.UK.

Read More

HSE, 17 August 2021

https://www.hse.gov.uk/reach/

Cosmetics tests on animals sneak back into the European Union

2021-08-23

Tests on animals for cosmetics ingredients and sales of animal-tested products are banned across the European Union (EU). Yet animals are still being poisoned and killed in tests for cosmetics ingredients there.

Are Animal Tests Banned in the European Union?

REACH Update

SEP. 10, 2021

Back in 2013, people all over world celebrated when a ban on animal testing for cosmetics came into full force in the EU. Europe had led the way in banning animal tests for cosmetics products and their ingredients—a ban based on the fundamental principle that no new cosmetics are worth the harm caused to animals in these deadly tests. The message was clear: No animal deserves to suffer and be killed for the sake of lipstick or toothpaste, and the EU was taking a stand against animal testing.

But under the guise of chemical-testing legislation called the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation, authorities are now demanding that some cosmetics ingredients be tested on animals under certain circumstances. At least 150 chemicals registered under REACH are ingredients used exclusively in cosmetics, and many of these are subject to new animal testing requests by the European Chemicals Agency.

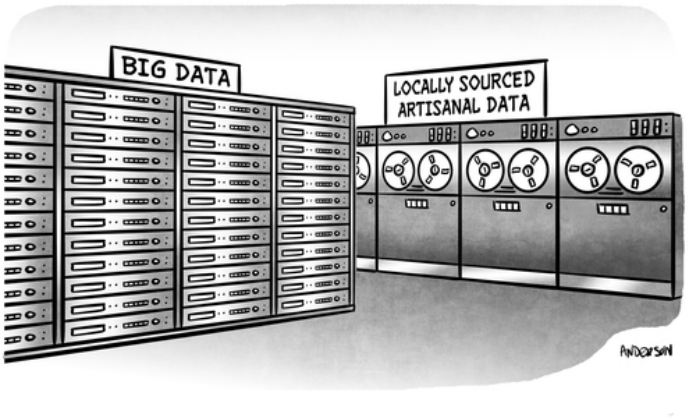
Read More

PETA, 23 August 2021

https://www.peta.org/blog/european-union-cosmetics-testing-ban-reach-loophole/

Data

2021-09-10



https://andertoons.com/data/cartoon/8523/big-data-locally-sourced-atisanal-data

Hexachlorocyclopentadiene (HCCPD)

2021-09-10

Hexachlorocyclopentadiene (HCCPD), also known as C-56, is an organochlorine compound that is a precursor to several pesticides. This colourless liquid is an inexpensive reactive diene. Many of its derivatives proved to be highly controversial, as studies showed them to be persistent organic pollutants. Collectively, the pesticides derived from hexachlorocyclopentadiene are called the cyclodienes. [1]

USES [2,3]

Hexachlorocyclopentadiene is used as a raw material in manufacturing other chemicals including certain pesticides. Most of the HCCPD in the environment results from releases during its production and disposal. It is also used to make flame-retardants, resins that won't burn, shockproof plastics, esters, ketones, fluorocarbons, and dyes. HCCPD has no end uses of its own.

Hexachlorocyclo-pentadiene (HCCPD), also known as C-56, is an organochlorine compound that is a precursor to several pesticides.

IN THE ENVIRONMENT [4]

HCCPD can be released to the air as a vapour during its production and use. However, it does not remain in the air very long since it is usually broken down to other substances by sunlight and by reaction with other chemicals in the air. Half of the HCCPD released to the air is removed in less than one day. When mixed with water at room temperature, only 2.1 milligrams will dissolve in a litre of water (2 parts per million or 2 ppm). In a stream or small river, the HCCPD near the surface will evaporate to the air. Sunlight on the water will cause HCCPD to change quickly into other chemicals. About half of the HCCPD in the water will be changed to other chemicals by the light in only four minutes. The HCCPD that gets into soil binds to decaying plant and animal matter. If the soil is sandy, the HCCPD can move through the soil and reach the water that is under the ground. When soil that contains HCCPD also contains solvents like gasoline, paint thinners, and acetone, these liquids will help carry the HCCPD through the soil to lakes, rivers, or wells. Bacteria can change HCCPD in the soil to other chemicals, but scientists do not know the nature of these compounds. About half of the HCCPD in the soil will be changed to other chemicals by bacteria in 1–2 weeks. HCCPD has been known to build up in fish, but only in very small amounts. It is unknown whether HCCPD accumulates in plants, milk, or animals used for food.

SOURCES & ROUTES OF EXPOSURE

Sources of Exposure [4]

- If you live near a hazardous waste site where HCCPD or HCCPD-derived pesticides were disposed, you might be exposed to HCCPD in the air. HCCPD has not been reported in outdoor air in city, suburban, and rural areas. In most areas, the concentration of HCCPD in the air should be low because this chemical is not widely used.
- HCCPD is not commonly found in surface water or drinking water, so exposure by this route is unlikely. However, it may be formed during chlorination of water containing humic acid.
- HCCPD may be present in soils that have recently been treated with the pesticides, endosulfan or pentac, because it is sometimes found as an impurity in these pesticides. The soils near a landfill where these pesticides (including those no longer used, such as aldrin, chlordane, dieldrin, endrin, heptachlor, and isodrin) or waste HCCPD were disposed might also contain HCCPD, but, since it binds to organic matter in soils, it is less likely to be free to affect you.
- It is highly unlikely that you will be exposed to HCCPD in the foods you eat, although you could be exposed to very small amounts if you catch and eat fish that lived in HCCPD-contaminated water.
- The highest exposures to HCCPD are likely to occur in people who are involved in the production or use of HCCPD, who handle pesticides made from it, or who treat wastes that contain it. These people can be exposed by breathing air contaminated with HCCPD, or by skin and eye contact with the vapours or liquid.

Routes of Exposure [5]

HCCPD can enter the body via the following routes:

- inhalation
- skin absorption
- ingestion
- skin and/or eye contact

HEALTH EFFECTS [6]

Acute Effects

Hexachlorocyclopentadiene is very toxic to humans. It is a severe eye, skin, and pulmonary irritant in humans. Inhalation of the chemical causes

tearing, sneezing, and salivation, and skin contact can cause blisters and burns. The major target organ for acute hexachlorocyclopentadiene toxicity is the lung, with cough, chest pains, and difficulty in breathing reported in humans. Nervousness, headaches, and abdominal cramps are other symptoms reported from hexachlorocyclopentadiene toxicity. Tests involving acute exposure of rats have shown hexachlorocyclopentadiene to have extreme toxicity by inhalation exposure, moderate toxicity by oral exposure, and high to extreme toxicity by dermal exposure.

Chronic Effects

Epidemiologic studies on workers have not shown any significant differences in mortality between workers exposed to hexachlorocyclopentadiene and those in the general population. However, these studies are limited by short follow-up periods, lack of data on cigarette smoking, and other factors. Chronic exposure to hexachlorocyclopentadiene, via inhalation, has been studied in animals, with effects noted in the lung, liver, kidney, and blood. EPA has established a Reference Concentration (RfC) of 0.0002 milligrams per cubic metre (mg/m^3) for hexachlorocyclopentadiene, based on respiratory effects in rats. The Reference Dose (RfD) for hexachlorocyclopentadiene is 0.006 milligrams per kilogram body weight per day (mg/kg/d) based on stomach lesions in rats.

Reproductive/Developmental Effects

No information is available regarding the reproductive or developmental effects of hexachlorocyclopentadiene in humans. Animal studies have not reported birth defects from exposure to hexachlorocyclopentadiene by gavage (placing the chemical experimentally in the stomach), and no information is available regarding reproductive or developmental effects from inhalation exposure.

Cancer Risk

Epidemiologic studies have not demonstrated any differences in mortality between hexachlorocyclopentadiene-exposed workers and the general population. The observed mortality included deaths from cancer, as well as from other diseases. The National Toxicology Program (NTP) completed a 2-year inhalation study and concluded that there was no evidence of carcinogenic activity in rats and mice. EPA has classified hexachlorocyclopentadiene as a Group D; not classifiable as to human carcinogenicity.

SAFETY

First Aid Measures

- Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
- Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
- Ingestion: Do not induce vomiting. Get medical aid immediately. Call a poison control centre.
- Inhalation: Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. SPEED IS ESSENTIAL, OBTAIN MEDICAL AID IMMEDIATELY. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

FIRE FIGHTING MEASURE

- As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.
- Substance may react with water, and may release corrosive and/or toxic gases.
- Do NOT use water directly on fire.
- Use foam, dry chemical, or carbon dioxide.

Exposure Controls and Personal Protection

Engineering Controls

- Facilities storing or utilising HCCPD should be equipped with an eyewash facility and a safety shower.
- Use only under a chemical fume hood.

Personal Protective Equipment

- Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
- Skin: Wear appropriate protective gloves to prevent skin exposure.

- Clothing: Wear appropriate protective clothing to prevent skin exposure.
- Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

REGULATION [4,8]

United States

- OSHA: The Occupational Safety & Health Administration has established limits on exposure to HCCPD in order to protect workers exposed on the job. The limit is 0.01ppm in the air for an 8-hour workday over a 40- hour workweek.
- NIOSH: The National Institute for Occupational Safety and Health (NIOSH) suggests the same limit for workplace air.
- EPA has recommended guidelines on how much HCCPD can be present in drinking water. The maximum contaminant levels (MCL) and maximum concentration level goal (MCLG) for drinking water are 50 ppb.
- EPA recommends that exposures in children should not exceed 2 ppm in water for 10-day periods or no more than 0.7 ppb for up to 7 years.
- If adults are exposed for more than 7 years, the EPA recommends that exposure levels should not exceed 50 ppb.
- HCCPD has been named a hazardous substance by EPA. If quantities equal to or greater than one pound are released to the environment, the National Response Centre for the federal government must be told immediately.

Australia

- Safe Work Australia: Safe Work Australia has established a time weighted average concentration for HCCPD of 0.1ppm and 0.11 mg/m^3 over an 8-hour workday.

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Fires may have affected up to 85 percent of threatened Amazon species

2021-09-01

Much of the Amazon's biodiversity is under fire — literally.

In the last two decades, deforestation and forest fires have encroached on the ranges of thousands of plant and animal species in the Amazon rainforest, including up to 85 percent of threatened species in the region, researchers report September 1 in Nature.

The extent of the damage is closely tied to the enforcement, or lack thereof, of regulations in Brazil aimed at protecting the forest from widespread logging as well as the fires often used to clear open space in the forest and other encroachments. The findings illustrate the key role that forest use regulations have in the fate of the Amazon rainforest, the researchers argue.

Threats to the survival of this biodiversity could have long-term effects. Biodiversity boosts a forest's resilience to drought, says Arie Staal, an ecologist at Utrecht University in the Netherlands who was not involved with this research. A deep bench of tree species allows the plants to replace those that may not survive drought conditions, he says. "If fire-impacted area continues to rise, not only does the Amazon lose forest cover, but also some of its capacity to cope with the changing climate."

Threats to the survival of this biodiversity could have long-term effects.

And as fires advance deeper into the rainforest, more species will experience fire for the first time, Staal says. "These species, including many threatened ones, have not evolved under circumstances with regular fires, so the consequences for those species can be severe." Such consequences may include increased risk of population declines or extinction, similar to the fears following the major outbreak of fires in Australia in 2019 and 2020 (SN: 3/9/21).

In recent decades, ongoing deforestation and periodic drought in the Amazon basin have been associated with intensifying fires there (SN: 11/20/15). In 2019, a particularly severe series of fires scorched the region (SN: 8/23/19).

"But we do not know how fires are impacting the biodiversity across the Amazon basin," says Xiao Feng, a biogeographer at Florida State University in Tallahassee. The Amazon "is a huge area, and it is generally impossible for people to go there and count the number of species before the fire and after the fire," he says. "That's an incredible amount of work."

So Feng and a team of collaborators from Brazil, China, the Netherlands and the United States instead investigated how Amazonian plant and animal species' geographic ranges have been exposed to recent fires. The team compiled range maps of 11,514 plant and 3,079 vertebrate species, creating what may be the most comprehensive dataset of range maps for the Amazon. The team compared these maps with satellite images of Amazon forest cover from 2001 to 2019. Those images let the team track how logging and fires have led to the degradation of rainforest habitat.

Fire impacted up to about 190,000 square kilometers — an area roughly the size of Washington state, the team found. Up to about 95 percent of the species featured in the study had ranges that overlapped with fires during this period, though for many species, burned areas made up less than 15 percent of their overall range.

Affected species include up to 85 percent of the 610 considered threatened — so vulnerable to extinction or already endangered or critically endangered — by the International Union for Conservation of Nature. This category includes as many as 264 kinds of plants, 107 amphibians and 55 mammals. In 2019 alone, over 12,000 species experienced fire somewhere in their geographic range.

Starting in 2009, when a series of regulations aimed at reducing deforestation started being enforced, the extent of fires generally decreased, except in drought years, the team found. Then in 2019, fires ticked back up again, coinciding with a relaxation of regulations. Much of the fire-driven forest loss was congregated along the more intensely logged southern reaches of the rainforest.

The shift suggests that effective forest preservation policies can slow this trend of destruction, and may be crucial for preventing the region from reaching a tipping point. That point would occur when the cycle of deforestation, drying and fire triggers widespread transformation of the Amazon basin into a savanna-like habitat.

While this study couldn't track the fate of specific plants or animals, Feng now plans to look at fire's impact on certain groups of species that may have very different vulnerabilities to an increasingly flammable Amazon. "We know some trees may be more resistant to burns, but some may not. So it may also be really important to distinguish differences," he says.

sciencenews.org, 1 September 2021

https://www.sciencenews.org

An 'internet apocalypse' could ride to Earth with the next solar storm, new research warns

2021-09-06

The sun is always showering Earth with a mist of magnetized particles known as solar wind. For the most part, our planet's magnetic shield blocks this electric wind from doing any real damage to Earth or its inhabitants, instead sending those particles skittering toward the poles and leaving behind a pleasant aurora in their wake.

But sometimes, every century or so, that wind escalates into a full-blown solar storm — and, as new research presented at the SIGCOMM 2021 data communication conference warns, the results of such extreme space weather could be catastrophic to our modern way of life.

In short, a severe solar storm could plunge the world into an "internet apocalypse" that keeps large swaths of society offline for weeks or months at a time, Sangeetha Abdu Jyothi, an assistant professor at the University of California, Irvine, wrote in the new research paper. (The paper has yet to appear in a peer-reviewed journal).

"What really got me thinking about this is that with the pandemic we saw how unprepared the world was. There was no protocol to deal with it effectively, and it's the same with internet resilience," Abdu Jyothi told WIRED. "Our infrastructure is not prepared for a large-scale solar event."

"Our infrastructure is not prepared for a large-scale solar event."

Part of the problem is that extreme solar storms (also called coronal mass ejections) are relatively rare; scientists estimate the probability of an extreme space weather directly impacting Earth to be between 1.6% to 12% per decade, according to Abdu Jyothi's paper.

In recent history, only two such storms have been recorded — one in 1859 and the other in 1921. The earlier incident, known as the Carrington Event, created such a severe geomagnetic disturbance on Earth that telegraph wires burst into flame, and auroras — usually only visible near the planet's poles — were spotted near equatorial Colombia. Smaller storms can also pack a punch; one in March 1989 blacked out the entire Canadian province of Quebec for nine hours.

Since then, human civilization has become much more reliant on the global internet, and the potential impacts of a massive geomagnetic storm on that new infrastructure remain largely unstudied, Abdu Jyothi said. In her new paper, she tried to pinpoint the greatest vulnerabilities in that infrastructure.

The good news is, local and regional internet connections are likely at low risk of being damaged because fiber-optic cables themselves aren't affected by geomagnetically induced currents, according to the paper.

However, the long undersea internet cables that connect continents are a different story. These cables are equipped with repeaters to boost the optical signal, spaced at intervals of roughly 30 to 90 miles (50 to 150 kilometers). These repeaters are vulnerable to geomagnetic currents, and entire cables could be made useless if even one repeater goes offline, according to the paper.

If enough undersea cables fail in a particular region, then entire continents could be cut off from one another, Abdu Jyothi wrote. What's more, nations at high latitudes — such as the U.S. and the U.K. — are far more susceptible to solar weather than nations at lower latitudes. In the event of a catastrophic geomagnetic storm, it's those high-latitude nations that are most likely to be cut off from the network first. It's hard to predict how long it would take to repair underwater infrastructure, but Abdu Jyothi suggests that large-scale internet outages that last weeks or months are possible.

In the meantime, millions of people could lose their livelihoods.

"The economic impact of an Internet disruption for a day in the US is estimated to be over $7 billion," Abdu Jyothi wrote in her paper. "What if the network remains non-functional for days or even months?"

If we don't want to find out, then grid operators need to start taking the threat of extreme solar weather seriously as global internet infrastructure inevitably expands. Laying more cables at lower latitudes is a good start, Abdu Jyothi said, as is developing resilience tests that focus on the effects of large-scale network failures.

When the next big solar storm does blast out of our star, people on Earth will have about 13 hours to prepare for its arrival, she added. Let's hope we're ready to make the most of that time when it inevitably arrives.PLAY SOUND

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https://www.livescience.com

Streetlights, especially super bright LEDs, may harm insect population

2021-08-31

Moths flock to streetlights, bewitched by their luminous brilliance. But bathing in brightness all night seems to have consequences for the grounded forms of these fliers. Illuminated stretches of English roads housed up to 52 percent fewer moth caterpillars than adjacent dark patches, researchers report August 25 in Science Advances. Streetlights could be contributing to declining insect populations in developed areas, the researchers say.

Artificial light is generally not good for nocturnal insects. Recent work hints the glow can mess with mating or disrupt pollination (SN: 5/13/15; SN: 8/2/17). But whether night lights contribute to population decline is understudied, says Douglas Boyes, an entomologist at the UK Centre for Ecology and Hydrology in Wallingford, England.

Boyes and colleagues compared 27 stretches of road that appeared identical except some parts were lit at night and others remained dark. Instead of looking at moth adults that can fly kilometers during their lives, the researchers counted caterpillars, which traverse just meters. At night, the team knocked dozens of species from roadside hedgerows or swept up larvae from grasses, catching nearly 2,500 caterpillars.

Artificial light is generally not good for nocturnal insects.

Hedgerows under bright LED lights contained 52 percent fewer caterpillars than dark sections, while areas under duller sodium lamps housed 41 percent fewer. On grassy sections, LED lights cut the population by 33 percent, while sodium lamps had little effect. LED lamps emit a broader spectrum of light than other lamps, which may explain their heightened influence. Caterpillars were fatter in lit sections, which probably indicates abnormal development, Boyes says, but how exactly LED light harms caterpillars remains unclear.

The United Kingdom's moth population has shrunk by a third in 50 years, but since less than 3 percent of the country lies under strong illumination from streetlights, habitat loss and climate change are more likely to blame than the lights, Boyes says. Still, the work highlights a relatively easy way to give some insects a break, he says. Just turn down the lights, or place filters on LEDs that narrow the spectra of light they shine down.

sciencenews.org, 31 August 2021

https://www.sciencenews.org

Exposure to air pollution below legal limits still linked to premature deaths

2021-09-02

Long-term exposure to air pollution is linked to higher levels of illness and mortality even when air pollution levels are well below legal limits, according to a new study.

Previous research has linked both acute and long-term exposure to high levels of common outdoor air pollutants like black carbon, nitrogen dioxide, and particulate matter (PM2.5) to higher risk of respiratory disease, heart disease, cancer, mental illness, and premature death.

The new study, published today in The BMJ journal, followed 325,367 adults from six European countries over a 20-year period. Around 14.5% (47,131 people) died during the study period, and researchers found that people with higher exposure to air pollution were more likely to die—even when air pollution levels remained below legal thresholds set by the U.S. Environmental Protection Agency (EPA), the European Union, and the World Health Organization (WHO).

The new study, published today in The BMJ journal, followed 325,367 adults from six European countries over a 20-year period.

"These findings are therefore an important contribution to the debate about revision of air quality limits, guidelines and standards," said researchers at the Institute for Risk Assessment Sciences at Utrecht University in the Netherlands in a statement. The Institute led an international team of researchers in conducting the study.

In the U.S., the legal threshold for PM2.5 is a yearly average of 12 micrograms per cubic meter (µg/m3), but the researchers found even among people exposed to levels below that limit, any increase of 5 µg/m3 in PM2.5 was associated with a 29.6% increase in natural deaths (deaths not caused by accidents or violence).

They also found that among people exposed to nitrogen dioxide at levels less than half the current EU limit of 40 µg/m3, any 10 µg/m3 increase in nitrogen dioxide was associated with a 9.9% increase in natural deaths. The U.S. threshold for nitrogen dioxide is 53 µg/m3.

The study has some limitations. It doesn't examine the physical pathways by which air pollution may have contributed to disease or causes of death, and it focused on air pollution exposures in 2010, which may have been higher than levels of exposure participants experienced in subsequent years.

The researchers analyzed air pollution levels and detailed health data for study participants from Sweden, Denmark, France, the Netherlands, Germany, and Austria, who were originally recruited in the 1990s or 2000s. Air pollution concentrations began dropping significantly in Europe in the 1990s due to new regulations, so the researchers launched the study with the goal of determining whether legal thresholds are adequate to protect people from the low levels of pollution that persist.

"Our study contributes to the evidence that outdoor air pollution is associated with mortality even at levels below the current European and North American standards and WHO guideline values," they concluded.

ehn.org, 2 September 2021

https://www.ehn.org

New 'mu' coronavirus variant could escape vaccine-induced immunity, WHO says

2021-09-02

Health officials are watching another new coronavirus variant, dubbed "mu," which they say has concerning mutations that could allow it to escape vaccine-induced immunity.

The variant, also known as B.1.621, was first detected in Colombia in January 2021, according to the World Health Organization (WHO). On Monday (Aug. 30), WHO classified it as a "variant of interest," or VOI, and named it mu.

The variant, also known as B.1.621, was first detected in Colombia in January 2021, according to the World Health Organization (WHO).

The VOI label means the variant is increasing in prevalence in multiple areas and has mutations that are likely to affect viral characteristics, such as transmissibility or disease severity, Live Science previously reported. In contrast, officials use the term "variant of concern," or VOC, once reliable data show that the variant has increased transmissibility — such as what's been seen with the delta variant — or other worrisome features, such as the ability to evade vaccines.

The mu variant "has a constellation of mutations that indicate potential properties of immune escape," WHO officials wrote in the agency's weekly epidemiological report on COVID-19, published Tuesday (Aug. 31). Early data in lab dishes show that antibodies generated in response to COVID-19 vaccination or previous infection are less able to "neutralize," or bind to and disable, the mu variant, the report said. However, this finding still needs to be confirmed by future studies. Mu shares some mutations

with the beta variant (a VOC), including mutations known as E484K and K417N, according to Medpage Today.

So far, the mu variant has been detected in 39 countries, including in some large outbreaks in South America and Europe. The variant has also been detected in the U.S. — a study from the University of Miami detected the variant in 9% of cases at the Jackson Memorial Health System in Miami, according to Medpage Today. Although the variant makes up less than 0.1% of all COVID-19 cases worldwide that undergo genetic sequencing, it accounts for 39% of sequenced cases in Colombia and 13% in Ecuador, and has been increasing in prevalence in these areas, the report said.

More studies are needed to better understand the mu variant and keep an eye on its spread, WHO said.

Exactly how transmissible mu is has not been determined, but Public Health England recently noted that the variant doesn't seem to be spreading particularly rapidly, and that it appears "unlikely" to be more transmissible than the delta variant. As a result "there is no indication that [mu] is out-competing delta" at this time, the agency said in a risk assessment of the variant. But the variant's ability to escape vaccine-induced immunity "may contribute to future changes in growth," the assessment said.

WHO is currently monitoring five variants of interest (eta, iota, kappa, lambda and mu) and four variants of concern (alpha, beta, gamma and delta).

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Hassan Abbas, an expert in environmental affairs, says that the plan to plant ten billion trees is being executed without any proper planning.

Pakistan: Environmentalists slam '10 billion trees' project

2021-09-02

The Pakistani government claims to have already planted over a billion trees as part of its ambitious plan, as well as having created around 85,000 jobs. Launched in 2019, the project — with support from the United Nations Environment Programme — is aiming to plant 10 billion trees by 2023.

The fifth most populous country in the world with over 24% of its people living in poverty, Pakistan is one of the states most vulnerable to the changing climate. Its growing population needs resources that are depleting fast but given that the country is facing increasingly variable monsoons, receding Himalayan glaciers and extreme events including floods and droughts, meeting those challenges will prove extremely difficult.

Bureaucratic missteps

The government has said that it launched the plan to reverse environmental degradation but critics believe that is not the case.

Hassan Abbas, an expert in environmental affairs, says that the plan to plant ten billion trees is being executed without any proper planning. Forests cannot be planted in isolation, he told DW, they need to have a canopy and understory where medicinal and herbal plants may flourish.

He explained that saplings have also been planted in places already suffering from water scarcity. This adds to the logistical costs which are coming out of the public coffers.

"It is not experts who are in charge of this project but bureaucrats who know less about forestation and causes of deforestation. They do not even know these terminologies, let alone understand the real causes that are destroying our environment," Abbas said.

Pakistan's former Inspector General of Forests Syed Mahmood Nasir agrees. He told DW that authorities first need to carry out an empirical study into the availability of water. Currently, groundwater has to be extracted for the plants, putting strains on already depleted reserves.

Budget lacking transparency

The government said that the project would cost a little over 125 billion rupees ($750 million, €633 million) but critics claim that other costs are being ignored.

Abbas says that in a particular desert area of Khyber Pakhtunkhwa province, one sapling needs a one-off provision of 15 rupees worth of water. "Imagine billions of trees and calculate the total cost, which could have been diverted for clearing the river banks, ensuring the flow of water from rivers that would have led to natural growth of trees without spending any money," he said.

Mahmood Nasir believes any plant that is grown outside its natural biome is expensive and environmentally disastrous. "Did anybody plant trees for the Amazon Jungle? Did the government plant tens of thousands of trees in northern areas of the country? Nature has its own mechanism for planting trees and you do not need to plant and look after them," the former forestry official said.

There are also further associated costs, a senior government official familiar with this project told DW on the condition of anonymity. "Administrative and other costs are not part of the allocated amount. For instance, recently in [the Gujranwala administrative region] 12,000 students were brought to plant over 50,000 saplings," he said.

He questioned the transparency of the publicly funded budget that does not include transport and other costs.

Not without negative impacts

Experts believe planting trees can be good for nature but doing so without due consideration can have negative effects.

Criticism has also been leveled at the project for impeding on land used for pasture. Those grazing animals can help prevent wildfires, Mahmood Nasir explained. "One of the factors leading to fire in various parts of the world is the elimination of grazing areas, which helps prevent such catastrophes," he said.

The project has banned those animals from those areas meaning that more wildfires can be expected in the future.

The project is also going to destroy natural water springs, he said, adding this could create an acute shortage of water as well as affecting the fertility of the land.

Alternative solutions

The government claims that the survival rate of the planted trees is over 60%, but some critics dispute this. "Many saplings planted in Gujranwala burnt within no time due to intense heat," said the senior government official. "They have not appointed sufficient staff to look after these trees and who will look after them in hilly areas and desert regions anyway?"

Instead of this costly project, the government should have targeted deforestation with strict administrative measures, the senior government official said.

In some areas, households burn over 10kg of wood every day. "Provision of solar geysers and cooking stoves, and a restriction on tree felling in northern and northwestern areas could help a lot," he said.

Some 40,000 hectares of forest are being destroyed every year, the senior official said. This could easily be prevented by tough action, he added.

Job creation claims under question

One international organization has claimed, citing the government's own data, that Pakistan's forest coverage has grown from 5% to 13% in just a few years. Government supporters have said that this will reach 31%, the global average.

Some international bodies have also claimed that the project has created around 85,000 jobs. But another anonymous government official questioned the validity of this claim, asking where the record is of these 85,000 workers.

The official criticized the lack of accountability and said that a number of people close to the chambers of power have set up nurseries from which the government buys the trees for planting. Government supporters are benefitting from the project, the official claimed.

A step in the right direction

There are, however, environmentalists who support the project and dismiss the criticisms leveled against it. They say that it will take decades for the already-existing environmental degradation to be reversed. For them, the government has taken positive action in the right direction.

Environmentalist Sitara Parveen from the mountainous Hunza region of northern Pakistan is happy about the move. A graduate of the German University of Heidelberg, Parveen insists that this is the first Pakistani government to take environmental issues very seriously.

"In my area people are being encouraged to plant trees which would help prevent natural disasters as well as providing a healthy environment," she told DW.

"I have seen the planting of thousands of trees in my own area," she said. She also claimed that if the project succeeds, it could change local rainfall patterns. Few people realize that such a change would transform Pakistan's

climate, not only protecting the country from disasters but also saving millions of lives, she added.

dw.com, 2 September 2021

https://www.dw.com

Alien-like cookiecutter sharks terrorize animals of all sizes

2021-09-03

Cookiecutter sharks are known for ripping small, cookie-shaped chunks out of sharks and whales much larger than themselves, but a new study finds that they actually terrorize animals of all sizes.

The green-eyed, alien-like sharks look like sinister sock puppets made of pastry dough and can grow up to 20 inches (50 centimeters) long. These odd creatures use their pointed teeth to feed off great white sharks 10 times their size and are even known to nibble chunks out of human flesh, Live Science previously reported.

Scientists frequently observed cookiecutter markings on larger animals and thus assumed that's what the sharks primarily ate. But it turns out, these sharks munch on animals at the bottom of the food chain as well, giving them a unique role in the ocean ecosystem, a new analysis of shark specimens finds.

"They feed on everything from the biggest, toughest apex predators — like white sharks, orcas, everything you can imagine — down to the smallest little critters," lead author Aaron Carlisle, an assistant professor in the School of Marine Science and Policy at the University of Delaware, said in a statement. "There's not very many animals that do something quite like this." Y SOUND

"There's not very many animals that do something quite like this." Y SOUND

Cookiecutter sharks (Isistius brasiliensis) live in tropical and subtropical waters and can inhabit depths of more than 4,920 feet (1,500 meters), according to the study. If humans see cookiecutter sharks, it's usually near the surface at night, when they come up to hunt larger prey in the upper ocean.

The researchers tested the assumption that these sharks mainly eat larger animals in the upper ocean by studying 14 cookiecutter sharks caught around Hawaii by the Monterey Bay Aquarium. The sharks' stomachs were mostly empty of food, but the team figured out what the animals had been eating by looking at the chemical composition of their tissues. The

team also checked for environmental DNA (eDNA), or the presence of DNA left behind even when there is no tissue to study.

"Environmental DNA is an increasingly popular and powerful tool that works under the idea that, if an animal swims by in the ocean, it's going to be shedding DNA in the water," Carlisle said. "So if you take a water sample and filter it out, you can extract the DNA of everything that's been in that water mass and identify what species were there. So we tried that on their stomach contents."

The researchers found that the cookiecutter sharks fed mostly on smaller species at lower depths, including crustaceans, squid and small fish, such as members of the genuses Ariomma and Cololabis. Some of these prey may be small enough for the sharks to swallow whole. In contrast, large animals from the upper ocean made up less than 10% of the sharks' diet, the study found.

These findings shed light on the behavior of this cryptic ocean creature. But the sample of sharks was small and from a limited geographic range, so it's unclear whether this feeding trend is the same throughout cookiecutter sharks' global range, according to the study.

The team published the findings June 3 in the journal Scientific Reports.

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https://www.livescience.com

"It's maybe too early to really know what we can do with it."

New 'vortex beams' of atoms and molecules are the first of their kind

2021-09-02

Like soft serve ice cream, beams of atoms and molecules now come with a swirl.

Scientists already knew how to dish up spiraling beams of light or electrons, known as vortex beams (SN: 1/14/11). Now, the first vortex beams of atoms and molecules are on the menu, researchers report in the Sept. 3 Science.

Vortex beams made of light or electrons have shown promise for making special types of microscope images and for transmitting information using quantum physics (SN: 8/5/15). But vortex beams of larger particles such

as atoms or molecules are so new that the possible applications aren't yet clear, says physicist Sonja Franke-Arnold of the University of Glasgow in Scotland, who was not involved with the research. "It's maybe too early to really know what we can do with it."

In quantum physics, particles are described by a wave function, a wavelike pattern that allows scientists to calculate the probability of finding a particle in a particular place (SN: 6/8/11). But vortex beams' waves don't slosh up and down like ripples on water. Instead, the beams' particles have wave functions that move in a corkscrewing motion as a beam travels through space. That means the beam carries a rotational oomph known as orbital angular momentum. "This is something really very strange, very nonintuitive," says physicist Edvardas Narevicius of the Weizmann Institute of Science in Rehovot, Israel.

Narevicius and colleagues created the new beams by passing helium atoms through a grid of specially shaped slit patterns, each just 600 nanometers wide. The team detected a hallmark of vortex beams: a row of doughnut-shaped rings imprinted on a detector by the atoms, in which each doughnut corresponds to a beam with a different orbital angular momentum.

Another set of doughnuts revealed the presence of vortex beams of helium excimers, molecules created when a helium atom in an excited, or energized, state pairs up with another helium atom.

Next, scientists might investigate what happens when vortex beams of molecules or atoms collide with light, electrons or other atoms or molecules. Such collisions are well-understood for normal particle beams, but not for those with orbital angular momentum. Similar vortex beams made with protons might also serve as a method for probing the subatomic particle's mysterious innards (SN: 4/18/17).

In physics, "most important things are achieved when we are revisiting known phenomena with a fresh perspective," says physicist Ivan Madan of EPFL, the Swiss Federal Institute of Technology in Lausanne, who was not involved with the research. "And, for sure, this experiment allows us to do that."

sciencenews.org, 2 September 2021

https://www.sciencenews.org

Antibiotics may raise colon cancer risk, massive study suggests

2021-09-08

Taking antibiotic drugs may raise the risk of developing colon cancer five to 10 years down the line, according to a new study of more than 40,000 cancer cases in Sweden.

Past studies hinted that antibiotics can cause lasting changes to the gut microbiome — the community of microbes that live in the digestive tract — and that these changes may be linked to a heightened risk of colon cancer. Now, in the largest epidemiological study to ever explore this link, researchers report that the heightened risk may be specific to cancers in the so-called proximal colon, the part of the colon that connects to the small intestine and starts in the lower-right abdomen.

"It's very clear, when we looked at the data, that it's very confined to the proximal, or right-sided colon," senior author Sophia Harlid, a cancer researcher at Umeå University in Sweden, told Live Science. And in fact, the antibiotic-related cancer risk was greatest at the start of the proximal colon, called the "ascending colon," which extends from the lower- to upper-right abdomen.PLAY SOUND

"It's very clear, when we looked at the data, that it's very confined to the proximal, or right-sided colon," senior author Sophia Harlid, a cancer researcher at Umeå University in Sweden, told Live Science.

People who took antibiotics for more than six months bore the highest cancer risk, according to the research, published Wednesday (Sept. 1) in the Journal of the National Cancer Institute. Compared with people who'd taken no antibiotics, these individuals had a 17% higher chance of developing cancer in the ascending colon.

That said, even short courses of antibiotics carried an associated cancer risk, albeit a far smaller one than what was seen with the months-long regimens, the team found. This data may provide yet another reason to rein in the overprescription of antibiotics, besides preventing the emergence of antibiotic-resistant superbugs, Harlid said.

These new findings echo the results of a similar, but smaller, U.K.-based study, published in 2019 in the journal Gut. The Swedish study "came right in line with other data that was emerging … which actually improves confidence that there's an association," Dr. Cynthia Sears, senior author of the U.K. study, who was not involved in the newest research, told Live Science.

It's important to note that these studies only identify a correlation; they don't show that antibiotics directly cause the subsequent colon cancer,

said Sears, who is a professor of medicine and oncology at the Johns Hopkins University School of Medicine and a professor of molecular microbiology and immunology at the Bloomberg School of Public Health. That said, there are theories as to how the drugs may make the proximal gut more vulnerable to cancer growth.

"Our thinking is that you're disrupting the balance of the microbiota," and this may allow infectious bugs like Escherichia coli and Klebsiella pneumoniae to gain prominence where they'd usually be outcompeted by other microbes, Sears said. This in turn may ramp up inflammation in the colon, generating reactive chemicals that could damage DNA and generate tumors. In addition, the inner lining of the intestine may then become more permeable, allowing bacteria to infiltrate the colon walls and join together in slimy structures called biofilms. Studies suggest that almost all proximal colon cancers — nearly 90% — are associated with such biofilms, Sears said.

The proximal colon may be particularly vulnerable to these changes because it endures the greatest spillover of antibiotic drugs from the small intestine, Sears said. Then, as the drugs move through the colon, their molecules steadily break down. That said, these potential mechanisms still need to be studied further, but for now, the new study strengthens the case that some link exists between antibiotics and colon cancer, she said.

The new study used data from the Swedish Colorectal Cancer Registry to identify tens of thousands of colorectal cancer patients who had been diagnosed between 2010 and 2016. Data from the Swedish Prescribed Drug Register allowed the team to track these patients' antibiotic use between 2005 to 2016, to see if any patterns emerged. They also compared the cancer patients to more than 200,000 cancer-free people from the wider Swedish population.

While the team uncovered a clear link between antibiotics use and cancer in the ascending colon, they found no such link to cancers in any part of the distal colon or rectum.

The team wanted to pin down why the drugs might drive cancer in the proximal colon. To do so, they searched the prescribed drug register for methenamine hippurate — a medicine that helps prevent urinary tract infections in people who get them frequently.

Although it has antibacterial effects, the drug doesn't alter the gut microbiome because it can only be activated by the high acidity of urine, Harlid explained. So based on the theory that antibiotics raise the risk of

cancer by messing with gut bugs, methenamine hippurate should not be linked to the same increased risk. And in sifting through all their data, the team found that this was the case: only antibiotics that affect gut bugs, not methenamine hippurate, showed a link to colon cancer.

These results further support the antibiotics-cancer link, but the study still has its limitations. For instance, the datasets didn't include any information on individuals' diets, smoking habits or alcohol use, all of which can also raise the risk of colon cancer. Similarly, the authors could not determine which patients might be taking antibiotics for an underlying condition like inflammatory bowel disease, also linked to colon cancer. In addition, the Swedish Prescribed Drug Register provides information on drug prescriptions, but cannot reflect whether individuals finished their complete course of antibiotics, for instance.

But because the study is so large, it "definitely hints in the right direction," Harlid said.

In a few years time, the team hopes to perform an even larger follow-up study, when more data has accumulated, and they're interested in seeing whether specific colon cancer subtypes show a stronger association with antibiotics. Cancers can be split into subtypes based on the behavior of their tumor cells and what genetic mutations they carry, and these subtle differences affect where the cancer grows and how it responds to treatments, according to the National Cancer Institute.

Meanwhile, Sears and her colleagues are currently collecting data on the microbiomes of individuals with early-stage colon cancer, to pinpoint specific gut bugs that are unusually depleted or overgrown. As scientists continue to study why microbes make a difference in colon cancer, for now, doctors should be selective in when and how they prescribe antibiotics, Sears said.

In theory, for those who do have to take antibiotics, dietary supplements could potentially be designed to help bring their microbiome back into balance, Sears said. One such supplement was recently trialed in malnourished children and helped them cultivate a diverse assortment of gut bugs, Live Science previously reported. But again, for now, the best course of action is simply to avoid taking antibiotics when they're not needed, she said.

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Gigantic 'shark-toothed' dinosaur discovered in Uzbekistan

2021-09-08

About 90 million years ago, a gigantic apex predator — a meat-eating dinosaur with serrated shark-like teeth — prowled what is now Uzbekistan, according to a new study of the behemoth's jawbone.

The 26-foot-long (8 meters) beast weighed 2,200 pounds (1,000 kilograms), making it longer than an African elephant and heavier than a bison. Researchers named it Ulughbegsaurus uzbekistanensis, after Ulugh Beg, a 15th-century astronomer, mathematician and sultan from what is now Uzbekistan.

The 26-foot-long (8 meters) beast weighed 2,200 pounds (1,000 kilograms), making it longer than an African elephant and heavier than a bison.

What caught scientists by surprise was that the dinosaur was much larger — twice the length and more than five times heavier — than its ecosystem's previously known apex predator: a tyrannosaur, the researchers found. PLAY SOUND

The chunk of jawbone was found in Uzbekistan's Kyzylkum Desert in the 1980s, and researchers rediscovered it in 2019 in an Uzbekistan museum collection.

The partial jawbone of U. uzbekistanensis is enough to suggest that the animal was a carcharodontosaur, or a "shark-toothed" dinosaur. These carnivores were cousins and competitors of tyrannosaurs, whose most famous species is Tyrannosaurus rex.

The two dinosaur groups were fairly similar, but carcharodontosaurs were generally more slender and lightly-built than the heavyset tyrannosaurs, said study co-researcher Darla Zelenitsky, an associate professor of paleobiology at the University of Calgary. Even so, carcharodontosaurs were usually larger than tyrannosaur dinosaurs, reaching weights greater than 13,200 pounds (6,000 kg). Then, around 90 million to 80 million years ago, the carcharodontosaurs disappeared and the tyrannosaurs grew in size, taking over as apex predators in Asia and North America.

The new finding is the first carcharodontosaur dinosaur discovered in Central Asia, the researchers noted. Paleontologists already knew that the

tyrannosaur Timurlengia lived at the same time and place, but at 13 feet (4 m) in length and about 375 pounds (170 kg) in weight, Timurlengia was several times smaller than U. uzbekistanensis, suggesting that U. uzbekistanensis was the apex predator in that ecosystem, gobbling up horned dinosaurs, long-necked sauropods and ostrich-like dinosaurs in the neighborhood, the team said.

"Our discovery indicates carcharodontosaurs were still dominant predators in Asia 90 million years ago," study lead researcher Kohei Tanaka, an assistant professor at the Graduate School of Life and Environmental Sciences at the University of Tsukuba in Japan, told Live Science in an email.

Peter Makovicky, a professor of paleontology at the University of Minnesota who was not involved in the study, agreed that U. uzbekistanensis was likely at the top of the local food chain. "I think this bone is so big that this would have been a very large predatory dinosaur and very likely the apex predator in its ecosystem," Makovicky told Live Science.

The U. uzbekistanensis finding is the last known occurrence of a carcharodontosaur and a tyrannosaur living together before the carcharodontosaurs went extinct, the team said. The team found that U. uzbekistanensis has unique bony bumps above its teeth. However, it also has bony ridges on the sides of its jaw that were similar to the 79.5 million-year-old tyrannosaur Thanatotheristes degrootorum (whose name means "reaper of death") from what is now Canada. It's unclear why both species have these ridges, but perhaps it's a case of convergent evolution, when species that aren't closely related evolve to have similar characteristics, Zelenitsky said.

The study was published online Wednesday (Sept. 8) in the journal Royal Society Open Science.

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https://www.livescience.com

Substituting even a bit of regular salt can reduce stroke, heart attack

2021-08-30

Replacing table salt with a low-sodium substitute lowers the risk of stroke and other cardiovascular diseases such as heart attacks as well as death, Medscape reports. Scientists gave nearly 12,000 people in China, who were either older than 60 and had high blood pressure or had a history of stroke, regular salt or 70% salt with a salt substitute (potassium chloride). After 5 years, those who used the salt substitute were 14% less likely to have a stroke, 13% less likely to experience a major cardiovascular problem, and 12% less likely to die of any cause, the team reported yesterday in The New England Journal of Medicine. Replacing regular salt with a lower sodium alternative is relatively cheap, and the researchers didn't find any apparent adverse effects, so they hope policymakers and the food industry consider making the switch.

science.org, 30 August 2021

https://www.science.org

Replacing table salt with a low-sodium substitute lowers the risk of stroke and other cardiovascular diseases such as heart attacks as well as death, Medscape reports.

Why is the color blue so rare in nature?

2021-09-06

When you look up at the blue sky overhead or gaze across the seemingly endless expanse of a blue ocean, you might think that the color blue is common in nature.

But among all the hues found in rocks, plants and flowers, or in the fur, feathers, scales and skin of animals, blue is surprisingly scarce.

But why is the color blue so rare? The answer stems from the chemistry and physics of how colors are produced — and how we see them.

We're able to see color because each of our eyes contains between 6 million and 7 million light-sensitive cells called cones. There are three different types of cones in the eye of a person with normal color vision, and each cone type is most sensitive to a particular wavelength of light: red, green or blue. Information from millions of cones reaches our brains as electrical signals that communicate all the types of light reflected by what we see, which is then interpreted as different shades of color.

When we look at a colorful object, such as a sparkling sapphire or a vibrant hydrangea bloom, "the object is absorbing some of the white light that falls onto it; because it's absorbing some of the light, the rest of the light

that's reflected has a color," science writer Kai Kupferschmidt, author of "Blue: In Search of Nature's Rarest Color" (The Experiment, 2021), told Live Science.

"When you see a blue flower — for instance, a cornflower — you see the cornflower as blue because it absorbs the red part of the spectrum," Kupferschmidt said. Or to put it another way, the flower appears blue because that color is the part of the spectrum that the blossom rejected, Kupferschmidt wrote in his book, which explores the science and nature of this popular hue.

In the visible spectrum, red has long wavelengths, meaning it is very low-energy compared with other colors. For a flower to appear blue, "it needs to be able to produce a molecule that can absorb very small amounts of energy," in order to absorb the red part of the spectrum, Kupferschmidt said.

Generating such molecules — which are large and complex — is difficult for plants to do, which is why blue flowers are produced by fewer than 10% of the world's nearly 300,000 flowering plant species. One possible driver for the evolution of blue flowers is that blue is highly visible to pollinators such as bees, and producing blue blossoms may benefit plants in ecosystems where competition for pollinators is high, Adrian Dyer, an associate professor and vision scientist at the Royal Melbourne Institute of Technology in Melbourne, Australia, told the Australian Broadcasting Company in 2016.

As for minerals, their crystal structures interact with ions (charged atoms or molecules) to determine which parts of the spectrum are absorbed and which are reflected. The mineral lapis lazuli, which is mined primarily in Afghanistan and produces the rare blue pigment ultramarine, contains trisulfide ions — three sulfur atoms bound together inside a crystal lattice — that can release or bind a single electron.

"That energy difference is what makes the blue," Kupferschmidt said.

Blue animals' colors don't come from chemical pigments. Rather, they rely on physics to create a blue appearance. Blue-winged butterflies in the Morpho genus have intricate, layered nanostructures on their wing scales that manipulate layers of light so that some colors cancel each other out and only blue is reflected; a similar effect happens in structures found in the feathers of blue jays (Cyanocitta cristata), the scales of blue tangs (Paracanthurus hepatus) and the flashing rings of venomous blue-ringed octopuses (Hapalochlaena maculosa).

Blue shades in mammals are even rarer than in birds, fish, reptiles and insects. Some whales and dolphins have bluish skin; primates such as golden snub-nosed monkeys (Rhinopithecus roxellana) have blue-skinned faces; and mandrills (Mandrillus sphinx) have blue faces and blue rear ends. But fur — a trait shared by most terrestrial mammals — is never naturally bright blue (at least, not in visible light. Researchers recently found that platypus fur glows in vivid shades of blue and green when exposed to ultraviolet (UV) rays, Live Science previously reported).

"But it takes a lot of work to make this blue, and so the other question becomes: What are the evolutionary reasons to make blue? What's the incentive?" Kupferschmidt said. "The fascinating thing when you dive into these animal worlds is always, who's the recipient of this message and can they see the blue?"

For example, while humans have three light-sensing receptor types in our eyes, birds have a fourth receptor type for sensing UV light. Feathers that appear blue to human eyes "actually reflect even more UV light than blue light," Kupferschmidt explained. By that reasoning, the birds that we call blue tits (Cyanistes caeruleus) "would probably call themselves 'UV tits,' because that's what they would mostly see," he said.

Because of blue's scarcity in nature, the word for blue was a relative latecomer to languages around the world, appearing after the words for black, white, red and yellow, according to Kupferschmidt.

"One theory for this is that you really only need to name a color once you can dye things — once you can divorce the color from its object. Otherwise, you don't really need the name for the color," he explained. "Dyeing things blue or finding a blue pigment happened really late in most cultures, and you can see that in the linguistics."

The earliest use of blue dye dates to about 6,000 years ago in Peru, and the ancient Egyptians combined silica, calcium oxide and copper oxide to create a long-lasting blue pigment known as irtyu for decorating statues, researchers reported Jan. 15 in the journal Frontiers in Plant Science. Ultramarine, a vivid blue pigment ground from lapis lazuli, was as precious as gold in medieval Europe, and was reserved primarily for illustrating illuminated manuscripts.

Blue's rarity meant that people viewed it as a high-status color for thousands of years. Blue has long been associated with the Hindu deity Krishna and with the Christian Virgin Mary, and artists who were famously

inspired by blue in nature include Michelangelo, Gauguin, Picasso and Van Gogh, according to the Frontiers in Plant Science study.

"The relative scarcity of blue available in natural pigments likely fueled our fascination," the scientists wrote.

Blue also colors our expressions, appearing in dozens of English idioms: You can work a blue-collar job, swear a blue streak, sink into a blue funk or talk until you're blue in the face, to name just a few. And blue can sometimes mean contradictory things depending on the idiom: "'Blue sky ahead' means a bright future, but 'feeling blue' is being sad," Kupferschmidt said.

Blue's scarcity in nature may have helped shape our perception of the color and things that appear blue. "With blue, it's like a whole canvas that you can still paint on," Kupferschmidt said. "Maybe because it is rare in nature and maybe because we associate it with things that we can't really touch, like the sky and the sea, it's something that is very open to different associations."

Editor's note: The article was updated Sept. 7 to reflect that lapis lazuli is mined in locations other than Afghanistan, though Afghanistan is the main source of the mineral.

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It is the first phase in what the Environment Minister calls the state's "war on waste".

Queensland's ban on single-use plastics begins

2021-09-01

Queensland businesses are now banned from selling or supplying some plastic and polystyrene products, as the state vows to tackle plastic pollution.

Key points:

- Businesses will be unable to sell or supply several items like plastic straws and cutlery
- The government hopes it will reduce pollution by 20 per cent over the next two years
- Disability advocates are asking businesses to be mindful of exemptions

Curiosities

SEP. 10, 2021

From today, the supply of single-use products including straws, cutlery, plates, bowls, stirrers and polystyrene takeaway containers and cups is banned.

It is the first phase in what the Environment Minister calls the state's "war on waste".

"[It's about] trying to reduce the amount of single-use plastics that end up in our oceans each year," Meaghan Scanlon said.

The Australian Marine Conservation Society (AMCS) has called the move a win for turtles, but disability advocates are encouraging businesses to be open-minded about exemptions.

'People are ready for this'

Under the policy, businesses can be fined up to $6,000 for non-compliance but will be given a month's grace period to abide by the new rules.

Ms Scanlon said the government was going for an education-first response but believed businesses were on track.

"So many businesses have already transitioned which is really great to see," she said.

"Overwhelmingly, we know people are ready for this.

"People are doing the right thing, they're using alternative suppliers because there are much more sustainable items on the market already."

The policy is the first stage of a wider ban that could see cuts of further products like coffee cups and heavy-duty plastic bags.

"We really encourage people to still, where possible, make the right choice; there are alternatives around coffee cups and other single-use items," Ms Scanlon said.

"Just because it's not banned, doesn't mean that you can't make a more sustainable option."

Plastic straws 'vital part' of life

Exemptions will be in place for some businesses to support people with disability or healthcare needs.

Perry Cross from the Perry Cross Spinal Research Foundation said the ban was welcomed but that plastic was necessary for some people with disability.

He said some paper straw alternatives could be problematic and not always a suitable fix.

"These days the technology has improved immensely, and now there's products hitting the market that are much more superior and they can do the job we need them to do," he said.

"Plastic straws have been on the way out for a while, so we've been aware of the problems.

"People need to understand that people need to use these things every day … they're a crucial part of our everyday society."

Mr Cross is urging businesses to be "environmentally and socially mindful" and look at the situation from someone else's point of view.

Safer for marine animals

The government hopes the ban will reduce the state's plastic pollution by about 20 per cent over the next two years.

Sea life, including turtles and sea birds, are at the centre of an international study as plastic ingestion becomes a concern for scientists.

AMCS plastics campaign manager Shane Cucow said the crackdown would make oceans "a little bit safer" for turtles and seabirds.

He said he hoped the next stage of the ban would come into effect soon.

"With states like Western Australia banning plastic cups, thick plastic shopping bags, takeaway coffee cups and helium balloon releases, the race to end wasteful plastic is heating up," he said.

mobile.abc.net.au, 1 September 2021

https://www.mobile.abc.net.au

Why is alcohol used to preserve things?

2021-09-05

If you've you've ever visited a laboratory or museum and admired a pristine eyeball or a tiny deceased critter floating in a glass jar, you've seen the preservation power of alcohol. The formal name of this technique is fluid preservation. Scientists have been relying on it since the 1600s to preserve their curious specimens. And, if done correctly, it can sustain a sample for hundreds of years, according to the American Museum of Natural History.

The formal name of this technique is fluid preservation.

But, how does it work?

"The long and the short of it is that it's toxic to the kinds of microorganisms that would cause decay," Bill Carroll, an adjunct professor of chemistry at Indiana University Bloomington, told Live Science. He used wine as an example. It's made as yeast eats sugar from grapes and then excretes alcohol. But the yeast excrete so much alcohol that the concentration becomes toxic and kills the yeast, he said. And that alcohol content — around 14% — helps delay the growth of bacteria for years (many wines also contain additional preservatives like sulfur), according to the California Wine Advisor.

PLAY SOUND

Preserving other organic material — such as DNA, tissues or even entire animals — requires a higher alcohol concentration, said Katherine Maslenikov, the fish collections manager at the Burke Museum in Seattle. Maslenikov typically relies on alcohol, specifically ethanol, for long-term storage.

For example, Maslenikov might take a fish specimen, remove some tissue samples for DNA analysis and inject the fish with formalin (a solution of formaldehyde gas dissolved in water) to stop the internal biological processes, such as enzymatic reactions and tissue degradation. Then, she might immerse the fish specimen in a jar of 70% alcohol, 30% water. For long-term storage, "70% seems to be that magic number," Maslenikov said. There's enough water in the solution that the tissues will stay hydrated, which helps the animal or specimen hold its shape, and there's enough alcohol to prevent mold and bacterial growth, she said.

Alcohol at even higher concentrations, for instance 95% ethanol, works as a dehydrant, meaning it removes and replaces the water in the cell, tissue or whole-body specimen with alcohol. The lack of water causes changes to water-sensitive proteins; they unfold, or denature, and harden in place next to one another, fixing the specimen's shape, according to Ask a Biologist, a series run by Arkansas State University. This technique is a common way of preserving DNA, according to a 2013 study in the journal PLOS One.

It can be tricky deciding what percentage of alcohol to use. Using too much or too little can affect the sample's shape and flexibility, or even lower its ability to preserve the sample in the solution. High concentrations of alcohol used to dehydrate a specimen will preserve it. But Maslenikov said this process can also leave a specimen shriveled (from

the loss of water) and brittle (from the hardened proteins). Sometimes that's OK; it all depends on what you are trying to preserve.

Meanwhile, a specimen might deteriorate quickly if it retains too much water.

"If an organism has enough water in its tissues, it can dilute the alcohol," Christopher Rogers, an associate research professor at the Kansas Biological Survey and Center for Ecological Research at the University of Kansas, told Live Science in an email. If this happens, the alcohol concentration might not be potent enough to kill lurking microorganisms that might be harbored deeper in the specimen, somewhere like the gut of a whole-animal specimen. Those missed bacteria can decompose the specimen. "This is why it is important to change the alcohol [about] 24 hours after pickling the critter," because it boosts the solution's alcohol concentration, Rogers said.

When it comes to using alcohol as a preservative, Carrol said you're looking for a concentration sweet spot: "A concentration such that you inhibit microorganisms, but not destroy the cell structure of what you're looking at."

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Can birds help us avoid natural disasters?

2021-09-01

Five years ago, French navy officer Jérôme Chardon was listening to a radio program about the extraordinary journey of the bar-tailed godwit, a bird that migrates 14,000 kilometers between New Zealand and Alaska. In his job as the coordinator of rescue operations across Southeast Asia and French Polynesia, Chardon understood better than most how treacherous the journey would be, as ferocious storms frequently disrupt Pacific island communities. Yet, somehow, bar-tailed godwits routinely pass through the area unscathed. Chardon wondered whether learning how godwits navigate could help coastal communities avoid disaster. Could tracking birds help save lives?

This past January, a team from France's National Museum of Natural History (NMNH), funded primarily by the French Ministry for the Armed Forces, began experiments designed to test Chardon's idea. Researchers

Could tracking birds help save lives?

with the new Kivi Kuaka project, led by Frédéric Jiguet, an ornithologist at NMNH, equipped 56 birds of five species with cutting-edge animal tracking technology. The French navy ferried the team to remote atolls and islands in French Polynesia, where the scientists attached tags using ICARUS tracking technology. These tags transmit the birds' locations to the International Space Station, which bounces the data back to scientists on Earth who can then follow the birds as they forage, migrate, and rest—all the while waiting to see how the birds respond to natural disasters.

The Kivi Kuaka project is focusing on birds' ability to hear infrasound, the low-frequency sound inaudible to humans ¬that the researchers believe is the most likely signal birds would use to sense storms and tsunamis. Infrasound has myriad sources, from lightning strikes and jet engines to the songlike vocalizations of rhinoceroses. Even the Earth itself generates a continuous infrasonic hum. Though rarely measured, it is known that tsunamis generate infrasound, too, and that these sound waves travel faster than the tsunami wave, offering a potential window to detect a tsunami before it hits.

There is some evidence that birds dodge storms by listening to infrasound. In a 2014 study, scientists tracking golden-winged warblers in the central and southeastern United States recorded what's known as an evacuation migration when the birds flew up to 1,500 kilometers to evade an outbreak of tornadoes that killed 35 people and caused more than US $1-billion in damage. The birds fled at least 24 hours before any foul weather hit, leaving the scientists to deduce they had heard the storm system from more than 400 kilometers away.

The idea that birds avoid tsunamis, on the other hand, is based primarily on anecdotal evidence from the 2004 Indian Ocean tsunami, when survivors reported birds traveling inland in advance of the deadly wave. Jiguet says the idea makes sense from an evolutionary perspective, because birds that survive tsunamis would be more successful at reproducing.

If Kivi Kuaka's birds are able to perceive infrasound generated by Pacific storms or tsunamis, the scientists suspect the birds will move to avoid them. Tracking that behavior, and learning to identify tsunami-specific bird movements if they exist, may help the team develop an early warning system, Jiguet says.

For the Kivi Kuaka team, tsunamis are the main interest; satellites and computer models already forecast hurricanes and typhoons accurately. But infrasound-producing storms are a useful test because they're more

common than tsunamis. If their tagged birds evade them from afar, Jiguet says, it provides further evidence that they could serve as tsunami sentinels.

The team plans on tagging hundreds more birds across the Pacific to prepare for a potential tsunami. "I think if there is one wave that spreads across islands, yes, we should get data from different species at different locations to see if there are some convergent behaviors," says Jiguet. "That would definitely say it's worth continuing to tag and to develop local systems to better analyze this."

Tsunami scientist Eddie Bernard, the former head of the US National Oceanic and Atmospheric Administration's Pacific Tsunami Warning Center and Pacific Marine Environmental Laboratory, has seen his fair share of ideas for forecasting tsunamis. He thinks the real hope for tsunami-warning technology is the one he helped develop, and which already dots coastlines today. Known as deep-ocean assessment and reporting of tsunamis (DART), the system relies on a highly sensitive pressure sensor anchored to the seafloor, which communicates with a surface buoy and satellite. DART detects differences in tsunami waves as small as a centimeter, a level of sensitivity that Bernard says solves the issue of false alarms that plagued past tsunami forecasting technology.

Bernard commends the Kivi Kuaka team's research. "The only thing I would say is don't overstress the tsunami warning aspect of this project," he says, noting that besides the importance of detection, measuring the wave's size is critical because most tsunamis are harmlessly small, and false alarms cause economic damage and erode public trust.

Jiguet is up front that the idea is uncharted. "I am at a point in my career when I can take such risks," he says. Even if the attempt to develop a bird-based tsunami early warning system fails, the project will still help scientists protect birds and benefit the French Ministry for the Armed Forces' mission of aiding climate change and biodiversity initiatives in the Pacific. In that sense, the research has already yielded results. Jiguet says their first season's tracking data highlights Hawai'i as an important stepping stone for the birds they tagged—a useful clue for conserving these species amid rising seas and an uncertain future.

hakaimagazine.com, 1 September 2021

https://www.hakaimagazine.com

Does your dog know what you're thinking?

2021-09-02

Scientists have long wondered whether dogs know what's going on inside of our heads—a sophisticated cognitive ability known as theory of mind. A new study adds more evidence that they do. Researchers attempted to pass a treat to a dog through a hole in a screen, and then either "accidentally" dropped it, tried to pass it but the hole was blocked, or intentionally withdrew the treat and said "ha ha!" In the last instance, the canines waited longer to walk around the screen to get the treat—and were more likely to stop wagging their tail—The Guardian reports. The finding indicates dogs can figure out whether we're doing something on purpose or by accident—and thus have some insight into what we're thinking, the team argues this week in Scientific Reports. But experts say more evidence is needed to determine whether our canine pals have a true theory of mind—a real understanding of the thoughts and intentions of others.

science.org, 2 September 2021

https://www.science.org

A new study adds more evidence that they do.

These popular tuna species are no longer endangered, surprising scientists

2021-09-06

In a world simultaneously on fire and underwater thanks to climate change, scientists have announced some good news: Several important tuna species have stepped back from the edge of extinction.

Two bluefin species, a yellowfin, and an albacore are no longer critically endangered or have moved off the leading international list of endangered species entirely.

The unexpectedly fast recovery speaks to the success of efforts over the past decade to end overfishing. But tuna are not the only species scientists are deliberating at the 2021 World Conservation Congress in Marseille, France, which is organised by the International Union for Conservation of Nature (IUCN). Researchers caution that many other marine species remain imperiled For instance, more than a third of the world's sharks and rays remain threatened with extinction due to overfishing, habitat loss, and climate change.

"I think the good news is that sustainable fisheries are possible," says Beth Polidoro, a marine biologist at Arizona State University. "We can eat fish sustainably and without depleting the population to the point where it is on the road to collapse or extinction."

At the same time, she warned that the changes in status should not be an incentive to lift quotas and catch as many fish as we want.

"We need to keep doing what's working," Polidoro says.

The IUCN, which ranks the world's most endangered species on its Red List of Threatened Species and is backed by 16,000 experts across the globe, also announced at the meeting that some animals are moving in the other direction, onto the Red List. One notable example is the Komodo dragon, an island-dwelling lizard at particular risk from climate change.

For the better part of two decades, Polidoro has been part of a specialist group tasked with assessing the statuses of more than 60 species of tuna and billfishes for the IUCN. Her team announced its first comprehensive findings in 2011, revealing that a number of commercially fished tuna species were dangerously close to disappearing.

Ten years on, Polidoro says she was surprised to see so much improvement.

According to the new data, the Atlantic bluefin tuna (Thunnus thynnus), once listed as endangered, now qualifies for a status of least concern. As does the yellowfin tuna (Thunnus albacares) and albacore tuna (Thunnus alalunga), which were both considered near-threatened the last time they were assessed. (Here's how to pick the most environmentally friendly canned tuna.)

Additionally, the southern bluefin tuna (Thunnus maccoyii) has improved from critically endangered to endangered, while bigeye tuna (Thunnus obesus) will remain at a status of vulnerable, and skipjack tuna (Katsuwonus pelamis) maintains its status of least concern.

How science is saving marvels of the sea

Most people think of tuna only as a potential dinner, but these fish are massive, marvellous creatures in their own right.

For instance, an Atlantic bluefin tuna begins its life as an egg no larger than the thickness of a credit card. But within a decade, it can grow to lengths of more than six feet and weights of more than 550 pounds. Tuna are fierce predators that zip through the ocean at speeds approaching 40

miles per hour, and they swallow their prey whole—whatever fits inside their gullet.

Though these animals would dwarf a pro rugby player, they're no match for modern fishing techniques. Beginning in the 1970s, longline fishing vessels dragging baited hooks hammered the largest Atlantic bluefin tunas as they gathered in the Gulf of Mexico to breed each year. At the same time, purse seine nets scooped up the smaller juveniles as they fed along North America's East Coast.

However, reduced catch quotas and enforcement of those quotas helped their comeback, says Polidoro. Improved data have also allowed for more accurate assessments and management decisions, she says.

A few caveats remain. After all, tuna inhabit vast expanses of the world's oceans and use different regions throughout their life cycles. This makes managing their populations rather complex. (Read more about why the Atlantic bluefin tuna has been drastically overfished.)

"Yellowfin tuna in the Indian Ocean is somewhat of a big black hole," says Polidoro. "We're not really sure what the status of the species is there, but it appears to be overfished."

Likewise, the western Atlantic population of the Atlantic bluefin tuna has been severely depleted since the 1970s and has yet to fully recover, she says.

Hope for Komodo dragons

Another significant development to come out of the World Conservation Congress is a change in the status of Komodo dragons (Varanus komodoensis). But this shift is less encouraging than for tuna.

As inhabitants of Indonesia's Sunda Islands, the world's largest lizards could see as much as 30 percent of their habitat affected by rising sea levels over the next 45 years, and this has prompted scientists to change the reptile's status from vulnerable to endangered.

"If we talk about climate change and sea level rise, I think most of the species that live in small islands will face the same problem," says Achmad Ariefiandy, an ecologist with an Indonesian nonprofit called the Komodo Survival Program, in an email. Ariefiandy was not involved with the listing decision.

Despite the looming existential threat, Komodo dragons may be better off than other species in the endangered category. The Indonesian

government has committed to saving the dragons, with a program that kicked off in earnest in 2013, says Ariefiandy. This includes partnerships between regional and local governments, as well as with local communities, academics, and nongovernmental organisations, he says.

"So the reality in the field at the moment [is that] they are actually doing just fine," says Ariefiandy.

Of course, the work of conservation is never over, and it will require vigilance to ensure neither tuna nor Komodo dragons slip back toward the brink. But for now, conservationists can celebrate a few wins for the animal world.

nationalgeographic.co.uk, 6 September 2021

https://www.nationalgeographic.co.uk

Mysterious object called 'The Accident' has been careening through the Milky Way for 10 billion years

2021-09-03

Astronomers have taken the first detailed look at a mysterious Milky Way object known as "The Accident" — and discovered that it's even more perplexing than previous studies indicated.

The Accident is not quite a star (scientists can tell from its dim glow that there's no nuclear fusion powering the object), and it's not quite a planet, either. According to a study published June 30 in The Astrophysical Journal Letters, The Accident is something in between — a rare class of object known as a brown dwarf, or a failed star.

…The Accident is something in between — a rare class of object known as a brown dwarf, or a failed star.

Brown dwarfs can be up to 80 times larger than Jupiter, but they typically hold just a tiny fraction of the mass of Earth's sun, according to Brittanica. Astronomers suspect that these objects start their lives like stars but don't accumulate enough mass to sustain nuclear fusion in their cores; instead, brown dwarfs slowly cool and dim over millions or billions of years until they're nothing more than dull red or purple embers.

While brown dwarfs are far too dim to see with the naked eye, scientists have detected about 2,000 such objects in the Milky Way using infrared telescopes, like NASA's Near-Earth Object Wide-Field Infrared Survey Explorer (NEOWISE). The Accident turned up in one such NEOWISE survey of the sky, when a citizen scientist caught a glimpse of the object swooping across the screen and photo-bombing a different group of

brown dwarf candidates. (This accidental discovery gave the object its nickname).

The Accident baffled scientists after its surprise discovery; it didn't look like a typical brown dwarf. The object appeared faint in some infrared wavelengths, suggesting it was a very cold and old brown dwarf, but it appeared bright in other wavelengths, indicating that it was a warm, young brown dwarf.

"This object defied all our expectations," leady study author Davy Kirkpatrick, an astrophysicist at Caltech in Pasadena, California, said in a statement.

This contradiction puzzled astronomers and sent them on a hunt to examine the illogical object with NASA's Hubble and Spitzer space telescopes, as well as the infrared telescope at the W. M. Keck Observatory in Hawaii. With this extra data, the researchers learned that The Accident is even stranger than they previously believed.

For one thing, it's moving fast. Located about 50 light-years from Earth, The Accident zooms through our galaxy at about 500,000 mph (800,000 km/h), which is much faster than a typical brown dwarf. According to the astronomers, this fact likely means that The Accident is very old and has been jostled around by the gravity of larger objects for billions of years, accelerating its movement.

The elements in the object's atmosphere are also puzzling. Based on the wavelengths of infrared light being emitted by The Accident, astronomers learned that the object is low in methane — a common gas in brown dwarfs with temperatures similar to The Accident, the team wrote. Because methane is composed of hydrogen and carbon, a methane scarcity suggests the object initially formed 10 to 13 billion years ago, when the Milky Way was filled almost entirely with hydrogen and helium but little carbon. (Carbon came later, as the oldest stars exploded and spread the element throughout the galaxy).

All this suggests that The Accident is an exceptionally old, incredibly cold brown dwarf that formed when the galaxy was poor in methane — making the object more than double the median age of all other known brown dwarfs.

"It's not a surprise to find a brown dwarf this old, but it is a surprise to find one in our backyard," said study co-author Federico Marocco, an astrophysicist at Caltech. "We expected that brown dwarfs this old exist,

but we also expected them to be incredibly rare. The chance of finding one so close to the solar system could be a lucky coincidence, or it tells us that they're more common than we thought."

Finding more ultra-old, ultra-cold brown dwarfs could be challenging, the researchers said, given how dim they appear even to the most sophisticated infrared telescopes. But with more eyes on the stars than ever before — thanks to trained astronomers and citizen scientists — it's only a matter of time before someone sees another accident.

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https://www.livescience.com

This pictogram is one of the oldest known accounts of earthquakes in the Americas

2021-09-07

A 50-page codex of colorful, complex pictograms that dates to the early 16th century includes the most complete — and one of the oldest — written chronologies of early earthquakes in the Americas.

The Telleriano-Remensis, which was created by an unknown pre-Hispanic civilization, describes 12 separate earthquakes that rocked what's now Mexico and Central America from 1460 to 1542, researchers report August 25 in Seismological Research Letters. The famous codex was written by specialists called tlacuilos, meaning "those who write painting" in the Nahuatl language spoken by Aztecs and other pre-Hispanic civilizations in the area (SN: 3/13/20).

Using other codices from the region, researchers had previously identified the combination of two pictographs that denotes an earthquake. One shows four helices around a central circle or eye, and stands for ollin, meaning "movement" in Nahuatl. The other pictograph shows one or more rectangular layers filled with dots, and means tlalli, or "earth." For daytime earthquakes, the eye is open; for nighttime quakes, it's closed.

Seismologist Gerardo Suárez of the National Autonomous University of Mexico and social anthropologist Virginia García-Acosta of the Center for Research and Higher Studies in Social Anthropology, both in Mexico City, pored over the Telleriano-Remensis. The researchers were looking for representations of quakes, comparing what they found to accounts of

Using other codices from the region, researchers had previously identified the combination of two pictographs that denotes an earthquake.

quakes in other pre-Hispanic codices and texts written later by Spanish friars.

The Telleriano-Remensis uses a pictorial representation of a 52-year cycle to roughly date the quakes. Years are represented by four signs— tecpatl (knife), calli (house), tochtli (rabbit) and acatl (reed) — arranged in 13 permutations. Those images helped the researchers match some pictorial accounts of quakes, including one in 1507, to later descriptions of the events.

Little more is recounted about the precise locations of these quakes or the damage they caused, although one image suggests that a quake triggered flooding that drowned warriors. Other codices may contain more clues, the researchers say, which could help create a more complete chronology of the quakes that shook this ancient world.

sciencenews.org, 7 August 2021

https://www.sciencenews.org

Why do we grind our teeth?

2021-09-04

Take a moment to recognize the tension in your body. Are your shoulders hunched? Are your eyes squeezed tight? Are your teeth clenched shut?

The latter, teeth clenching, is a medical condition called bruxism. And for some people, it can cause real problems, such as headaches, jaw pain and damaged teeth.

There are two types of bruxism, said Katayoun Omrani, a dentist who specializes in orofacial pain at the Cedars-Sinai Pain Center in Los Angeles: awake bruxism and sleep bruxism. As the terms suggest, awake bruxism is when people clench their teeth while awake, and sleep bruxism is when they clench or grind them while asleep.PLAY SOUND

The main trigger of bruxism may be fairly obvious: Stress and anxiety are the top causes, Omrani told Live Science. But other factors can play a role. A major one is the use of selective serotonin reuptake inhibitors (SSRIs), a type of antidepressant, according to a systematic review of case reports published in the journal Neurology Clinical Practice. "That's the question I always ask: How long have you been on this medication, and do you feel like your bruxism has worsened since you've been on this medication? In the majority, I find an association," Omrani said.

And for some people, it can cause real problems, such as headaches, jaw pain and damaged teeth.

Smoking, drinking a lot of caffeine or alcohol, and acid reflux can also increase a person's risk of bruxism, she said. Despite suspicions that sleep apnea increased risk of sleep bruxism, a 2020 review published in the journal Sleep and Breathing did not find a conclusive link between the two.

Bruxism is a rather common condition. About a third of adults experience awake bruxism, and 1 in 10 have sleep bruxism, according to the Mayo Clinic. For many of those people, the condition isn't much of a medical issue. But for some, it can cause neck pain, jaw pain, headaches, a receding gumline and damage to the teeth that may require crowns or tooth extraction. The nerves in the teeth can be so irritated, in fact, that a person may need a root canal, Omrani said. These symptoms are usually associated with sleep bruxism rather than awake bruxism, she added.

Treatment for awake bruxism is simpler. "With daytime clenching, you could teach [people] not to do it by keeping their teeth separate and constantly reminding themselves, 'Am I clenching?'" Omrani said. People can also work with a pain psychologist to identify what triggers their teeth clenching and to learn stress management.

It's impossible to notice and stop your clenching while asleep, so treating sleep bruxism requires different techniques. First and foremost, Omrani recommended wearing a dental night guard, which is like a customized mouth guard that you wear at night. It won't stop the grinding, but it can protect the teeth and jaw muscles, Omrani said. If the person is on SSRIs, they may need to switch to a different type of antidepressant. And if the pain is severe, patients can be prescribed muscle relaxants to take at night, or they may opt for Botox injections to the facial muscles to help them relax, she said.

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Characterization of aerosols produced during shampoo use and harmful chemicals in shampoo aerosols

ENVIRONMENTAL RESEARCH

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OCCUPATIONAL

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