CHEMWATCH

Bulletin Board

Contents

APR. 30, 2021

(click on page numbers for links)

CONTACT US

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

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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

Contents

APR. 30, 2021

CHEMWATCH
Bulletin Board
Contents
APR. 30, 2021

ASIA PACIFIC

Experts warn of pollution from unregulated new-energy battery recycling system

2021-04-14

As the amount of waste batteries from new-energy vehicles has reached nearly 200,000 tons in China, experts are warning of environmental pollution and safety issues as large numbers of used power batteries are recycled and processed without any regulation.

According to a report by Xinhua on Monday, the waste power batteries from new-energy cars in China have reached nearly 200,000 tons as of 2020, and the number is expected to reach 750,000 in 2025.

Zhong Shi, an automotive industry analyst, told the Global Times on Tuesday that after an unregulated battery-recycling workshop buys used batteries, "they tend to carry out a rather simple recycling process, discarding useless materials such as electrolyte at will, which could cause serious soil pollution."

Zhang Zheming, an associate researcher from the Shenzhen Automotive Research Institute, told Xinhua that due to the lack of supervision and standard operation during the recycling process, there might be risks of explosion when disassembling the batteries.

China Power Battery Recycling and Ladder Utilization Union has put a total of 22 Chinese companies on the white list, meaning that they are authorized to recycle and utilize used power batteries as of 2020.

Read more

Global Times, 14 April 2021

https://www.globaltimes.cn/page/202104/1221004.shtml

…and the number is expected to reach 750,000 in 2025.

A fossil fuel frenzy is drinking Australia's finite water resources

2021-04-14

The Productivity Commission has produced a 232 page Draft Report on the functioning of the 2004 National Water Initiative (NWI).

This is a report on the future of Australia, for water is our life support system in a drying continent.

CHEMWATCH
Bulletin Board
Regulatory Update
APR. 30, 2021

The black coal industry in New South Wales and Queensland uses 383 billion litres of fresh water every year, the same as five million people.

Gas industry water usage is also prodigious. Shale gas mining uses 4 to 24 million litres in each hydraulic fracturing event which can be applied many times per well across hundreds to thousands of wells in an area.

This water use in the Surat Basin of Queensland may render the region unsustainable,and gas expansion in Queensland's fragile regions is never ending.

For those who regularly review the environmental impact assessments for resource developments, which include the impact on essential environmental water, approval and regulation by government appears to be in a parallel universe operating light years from NWI regulations.

In 2012, in response to community concerns, the Australian Government established an Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) under the EPBC Act.

Advice is sought from the IESC by the Federal Environment Minister or by state governments.

In practice deep concerns expressed by the IESC are often disregarded by states where a single 'water expert" maybe used to contest them, or the IESC requirements are not adhered to, or not monitored, and there is no transparency in decision making.

Read More

Renew Economy, 14 April 2021

https://reneweconomy.com.au/a-fossil-fuel-frenzy-is-drinking-australias-finite-water-resources/

China releases the 2021 list of air transport Dangerous Goods

2021-04-22

On March 30, 2021, the Civil Aviation Administration of China (CACC) published the *2021 List of Air Transport Dangerous Goods* [1] to replace its 2019 version. The List was first released in 2015 and has been updated every two years.

The List was first released in 2015 and has been updated every two years.

Read More

Chemlinked, 22 April 2021

https://chemical.chemlinked.com/news/chemical-news/china-releases-the-2021-list-of-air-transport-dangerous-goods

AMERICA

PFAS: The "Forever Chemicals" in consumer products and why businesses should take care in their marketing

2021-04-08

PFAS (per- and poly-fluoroalkyl substances) have garnered significant national attention in the last few years. PFAS have made recent headlines in multi-million dollar settlements, Biden campaign promises, proposed EPA rules, congressional hearings, and state-level regulatory efforts across the country. For more about these activities and further background on PFAS please see this previous post.1 Growing public attention to PFAS (and thus, PFAS presence in consumer products) is consistent with recent trends in consumer demand for environmentally friendly or "green" products. Businesses have responded to this interest in green products by increasing their environmental marketing efforts, particularly with respect to highlighting the absence of a PFAS known as PFOA (perfluorooctanoic acid). But with a larger spotlight on a PFAS family consisting of thousands of unique chemicals, businesses should take care to manage how they advertise product information to consumers to avoid running afoul of U.S. regulations against deceptive advertising. The Federal Trade Commission's ("FTC") Guides for the Use of Environmental Marketing Claims (the "Green Guides") set forth federal guidance for businesses to help navigate issues like this one.2

Background on the Green Guides

The Green Guides were first issued in 1992 and lay out general principles businesses should consider when making an environmental claim about a product. The Green Guides also include guidance on how businesses should expect consumers to interpret specific claims and, importantly, how businesses can appropriately limit or qualify their environmental marketing claims to avoid misleading consumers. The Green Guides are not FTC rules or regulations, rather, they serve to warn about the types of marketing claims the FTC might find deceptive and therefore be in violation of Section 5 of the FTC Act ("Section 5").3 The FTC can bring

Growing public attention to PFAS (and thus, PFAS presence in consumer products) is consistent with recent trends in consumer demand for environmentally friendly or "green" products.

CHEMWATCH
Bulletin Board
Regulatory Update
APR. 30, 2021

an enforcement action if it believes that all reasonable interpretations of an environmental marketing claim are not truthful, are misleading, or are otherwise "not supported by a reasonable basis."4 Accordingly, any business looking to avoid an FTC enforcement action over its PFAS marketing (or any environmental marketing) should take care to review the Green Guides.

Read More

JD Supra, 8 April 2021

https://www.jdsupra.com/legalnews/pfas-the-forever-chemicals-in-consumer-1758593/

Calif. bill would ban 'forever chemicals' in products for children

2021-04-08

SACRAMENTO, Calif. – State legislation that would ban the toxic **"forever chemicals"** known as PFAS from a wide range of children's products passed out of the California Assembly Environmental Safety and Toxic Materials Committee on Wednesday.

Assembly Bill 652, authored by Assemblymembers Laura Friedman (D-Burbank), with co-authors Phil Ting (D-San Francisco) and Al Muratsuchi (D-Torrance), would assure parents that a wide variety of baby and kids products they purchase are free from PFAS, a group of chemicals that cause **increased risk of cancer**, **harm to fetal development** and **reduced vaccine effectiveness**. PFAS are known as "forever chemicals" because they do not break down in the environment and they build up in our blood and organs.

"PFAS contamination is a national environmental and public health emergency," said **David Andrews, Ph.D**., a senior scientist at the Environmental Working Group. "Children are particularly vulnerable to harm resulting from PFAS exposure. Many PFAS chemicals bioaccumulate and are found in the blood of almost all Americans, including infants and children. It is critical that we eliminate unnecessary exposure to this family of chemicals as much as possible."

The U.S. Environmental Protection Agency has not set a legal limit for PFAS under the Safe Drinking Water Act, but independent studies have found that a safe level is no more than 1 part per trillion, or ppt, a finding that is **endorsed by EWG**.

PFAS are known as "forever chemicals" because they do not break down in the environment and they build up in our blood and organs.

In a **study** published by Environmental Science & Technology Letters, a group of U.S. and international scientists emphasized that the current approach to regulating and managing PFAS has failed to protect public health. The study recommended a new approach that classifies all PFAS as concerning and calls for an end to all non-essential use.

"This bill puts California in the lead of protecting children," said **Bill Allayaud**, EWG's director of California government affairs. "The new so-called short-chain PFAS behave much like the long-chain chemicals they are replacing. We need to be proactive in regulating exposure to this entire family of toxic chemicals."

"PFAS are stain-resistant," said Assemblymember Friedman during the committee hearing. "Are you willing to risk the health of your baby or child for that convenience? I'd take the stain over the toxic exposure any day of the week."

"As a mother there is only so much I can do," said Assemblymember Rebecca Bauer-Kahan, a member of the committee. She noted that the state's "green chemistry" program "is really important and has been around for more than a decade, but only made three rules. Clearly they're not moving fast enough."

Read More

EWG, 8 April 2021

https://www.ewg.org/news-insights/news-release/calif-bill-would-ban-forever-chemicals-products-children

FDA to urge limits on heavy metals in baby foods, starting with arsenic

2021-04-13

The Food and Drug Administration, after congressional pressure, is now pursuing a plan to address high levels of heavy metals in baby foods. Although the agency has set maximum allowable levels of metals like lead in bottled water, it has not regulated levels of metals in baby and toddler foods, with the exception of arsenic in rice cereal.

But spurred by a congressional report in February that found many of the products made by the country's largest commercial baby food manufacturers contain significant levels of lead, arsenic, cadmium and mercury, advocacy groups, members of Congress and outraged parents have urged the agency to act.

These maximum levels will be recommended and voluntary for manufacturers.

CHEMWATCH
Bulletin Board
Regulatory Update
APR. 30, 2021

The FDA's plan outlines a multiyear process of evaluating the science, establishing maximum acceptable levels, monitoring manufacturers' compliance with those levels and taking enforcement actions. These maximum levels will be recommended and voluntary for manufacturers.

"Although action levels are not binding, we have seen that, over the years, our guidance on action levels and other actions have contributed to significant reductions of toxic elements in food," an FDA spokeswoman wrote in a statement.

Heavy metals can leach into fruits and vegetables from soil or water contaminated by pesticides, fertilizers and other sources. They can also be introduced to baby foods as additives and mineral or vitamin mixes. While pediatricians and nonprofits such as Healthy Babies Bright Futures say levels in individual baby foods do not pose a significant risk, protracted exposure over time can cause lasting neurodevelopmental disabilities in children.

Advocacy groups such as Consumer Reports and Environmental Working Group say the FDA's move represents a positive development after years of inaction by the agency on this topic, but they are concerned the plan may not go far enough.

Read More

The Washington Post, 13 April 2021

https://www.washingtonpost.com/business/2021/04/12/fda-toxic-baby-food/

EUROPE

The new scheme that could create cleaner air and safer travel for school children in Manchester

2021-04-16

During the first national lockdown in spring 2020, the streets of our towns and cities were almost deserted leading to a widely reported improvement in air quality standards.

However, lockdown 3.0, the UK's latest series of national restrictions that started in January 2021, saw traffic levels across the UK's major cities, including Manchester, remain at more than 80% of the pre-COVID-19 levels according to our latest data.

So, with children now back at school, and roads across the country already congested, we need to ask: "What toxic pollutants are children living in major towns and cities currently being exposed to?"

These latest findings have led to real concerns that, as restrictions continue to ease in the coming months, traffic levels may actually surge ahead of pre-lockdown levels. This is a particular concern as many people are opting to use their car ahead of public transport when travelling.

It is no secret that emissions from road traffic have the greatest single impact on our air quality so for the long-term health of the nation we must do more to reduce these rising pollution levels.

So, with children now back at school, and roads across the country already congested, we need to ask: "What toxic pollutants are children living in major towns and cities currently being exposed to?"

The power of School Street Zones

To help improve the air quality around schools, schemes like 'School Street Zones' are increasingly being introduced. This ensures the immediate areas outside education settings are kept clear of traffic during the busy 'drop-off' and 'pick-up' times. The zones are already not only improving air quality but also significantly advancing road safety in the streets around a school – helping promote active travel choices for parents and their children.

School Street Zones are a designated area of typically one road with a camera at the start and end of the zone, but multiple roads can be covered by the installation of more cameras. Each camera is able to monitor vehicles as they enter the area during specified periods and Siemens Mobility has now deployed this solution across a number of local authorities with the company's automatic number plate recognition (ANPR) cameras at the heart of the scheme.

Read More

Manchester Evening News, 16 April 2021

https://www.manchestereveningnews.co.uk/special-features/new-scheme-could-create-cleaner-20396131

CHEMWATCH
Bulletin Board
Regulatory Update
APR. 30, 2021

INTERNATIONAL

Changes of MARPOL Regulation may be needed to facilitate widespread use of biofuels, says IMO

2021-04-14

Modifications of Regulation 18 under MARPOL Annex VI Regulations for the Prevention of Air Pollution from Ships will need to be considered in order to promote more shipowners to adopt biofuels as a bunker fuel, says the Head, Air Pollution and Energy Efficiency at the International Maritime Organization (IMO).

Roel Hoenders was responding to a question at Session One: IMO Regulatory Changes during the *International Bunker Industry Association (IBIA) 'Bunkering & Shipping in Transition' conference* on Monday (12 April).

The enquirer suggested how biofuels, which generally emit more nitrogen oxides (NOx) to the environment, seem to be in conflict with the current MARPOL Regulation 18 – that suggests bunker fuels consumed cannot cause an engine to exceed its current NOx emission tier limit.

"I don't have an immediate suggestion but what I do know is that this is an issue. I am aware that member states, or at least some of the member states, are faced with this issue when promoting some of their owners to use biofuels as an alternative bunker fuel," replied Hoenders.

"Particularly looking at the carbon intensity requirements that IMO is likely to adopt later this year, biofuels are very likely going to be part of the fuel mix by 2030.

"We expect to see some submissions on this very specific issue coming already to MEPC 76 and I'm not sure whether the MEPC 76 session in June will have the time to look into this in detail. But it will definitely be a topic that needs to be followed up in the coming sessions where further work is required."

According to Hoenders, IMO's overall objective is to move towards decarbonisation while reducing air pollution at the same time.

"We need to make sure these kind of barriers from a legal nature are looked into and resolved as much as we can. We expect documents coming in, and we expect the [MEPC] committee to work on this in its coming sessions."

Read More

Manifold Times, 14 April 2021

https://www.manifoldtimes.com/news/changes-of-marpol-regulation-may-be-needed-to-facilitate-widespread-use-of-biofuels-says-imo/

'Invisible killer': WHO particulate standards should become legally binding, says coroner

2021-04-21

The coroner who declared that young Londoner Ella Kissi-Debrah's death was caused by exposure to air pollution says that adopting tighter legal limits on particulate concentrations would reduce the death toll from the pollutant.

Ella died of a rare and extreme form of asthma in 2013 at the age of nine, having been hospitalised dozens of times beforehand. Following a long campaign, her death certificate was revised earlier this year to include air pollution as a factor. It was the first time such a ruling had been made, though epidemiologists have long concluded that dirty air kills tens of thousands of people per year in the UK alone and millions around the world.

"The national limits for particulate matter are set at a level far higher" than guidelines published by the World Health Organization (WHO), Philip Barlow, assistant coroner for inner South London, wrote in a 'prevention of future deaths' report released today.

"The evidence at the inquest was that there is no safe level for particulate matter and that the WHO guidelines should be seen as minimum requirements. Legally binding targets based on WHO guidelines would reduce the number of deaths from air pollution in the UK," Barlow added.

The government at first said that the Environment Bill would set the recommendations in law directly, then reversed course and said that a new target would be set by October 2022. The whole of the capital breaches the WHO guideline level of ten micrograms per cubic metre, as do many other towns and cities across the UK.

Ella died of a rare and extreme form of asthma in 2013 at the age of nine, having been hospitalised dozens of times beforehand.

ECHA public consultation: call for comments – deadline 18 June 2021

2021-04-22

The Great Britain Mandatory Classification and Labelling (GB MCL) process includes the consideration of information gathered from public consultations, conducted by HSE or international bodies such as the European Chemicals Agency (ECHA).

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

- 12-[ethyl[3-methyl-4-[(5-nitrothiazol-2-yl)azo]phenyl]amino]ethanol (EC: 271-183-4; CAS: 68516-81-4). Chemical registered under REACH
- dicamba (EC: 217-635-6; CAS: 1918-00-9). Pesticide active substance

The details can be viewed here.

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

Scientific and technical information should be submitted directly to ECHA using their commenting webform by **18 June 2021**.

Comments will be published on ECHA's website.

If your business is affected by the GB CLP Regulation, please also consider if you are likely to be affected by any of the classification and labelling proposals and let us know at an early stage if you anticipate any significant impacts or benefits.

Information on wider policy and impact considerations can be submitted to HSE at GBCLP.GBMCL@hse.gov.uk.

Under the GB CLP Regulation, HSE will consider all published opinions of the Committee of Risk Assessment of ECHA (RAC) before publishing its own Agency Technical Reports and Agency Opinions, so any information you provide will be important in any final GB MCL decision.

More information on the new GB MCL system is available on the HSE website.

HSE, 22 April 2021

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

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

Nearly 300 chemicals identified as candidates for regulatory action

2021-04-21

In 2020, ECHA assessed around 1 900 registered chemicals in groups. 290 of these may be candidates for further regulatory risk management at EU level if their hazards are confirmed.

Helsinki, 21 April 2021 – ECHA's third report on its Integrated Regulatory Strategy gives the latest on the Agency's work to identify and manage chemicals that may pose risks to people and the environment, as well as recommendations to authorities and industry on managing the risks.

Last year, ECHA continued addressing groups of structurally similar substances instead of assessing each chemical individually. This group approach boosted the total number of chemicals assessed in 2020 to around 1 900 – which is twice as many as in 2019 and ten times the amount screened annually between 2014 and 2018.

From the group assessments concluded in 2020, 290 chemicals were identified as candidates for further EU regulatory risk management. Most of these will, however, require more data to be generated and confirmation of hazard before any actions can start.

Harmonised classification is often a prerequisite for risk management actions under REACH or other EU legislation. There are over 100 substances identified, which based on currently available information, would warrant harmonised classification, but which have so far not been picked up by authorities. A lack of harmonised classification may delay risk management actions by companies or authorities.

The group assessments have also shown that, based on the hazard and use information currently available, there is presently no need for further risk management at EU level for about two thirds of the substances assessed.

The progress made in clarifying the need for regulatory action for all registered substances above one tonne, can be followed through the chemical universe.

Recommendations

While ECHA will continue working on groups of substances and optimising its group approach, it is important that:

From the group assessments concluded in 2020, 290 chemicals were identified as candidates for further EU regulatory risk management.

CHEMWATCH
Bulletin Board
REACH Update
APR. 30, 2021

- Member States ensure adequate resources and initiate regulatory risk management for substances that require further action without delay.
- Member States intensify collaboration with each other to maximise the outcome of their work.
- Industry makes use of programmes developed to help them to review and update data in their REACH registration dossiers. The updates must be done proactively and not only after authorities take regulatory action.

Background

ECHA's Integrated Regulatory Strategy aims to accelerate data generation, identification of groups of substances of concern, and regulatory action. It does so by providing a setup where different regulatory processes can be coherently, effectively and efficiently used, and by encouraging collaboration between ECHA, Member States and the European Commission.

ECHA has created a mapping tool of all registered substances called the chemical universe in which each substance is assigned to a pool that indicates the regulatory actions already initiated or under consideration for that substance. It also identifies those substances for which the need for suitable regulatory actions still needs to be determined.

The goal is to clarify by 2027 which registered substances are a high priority for regulatory risk management or data generation, and which are currently a low priority for further regulatory action

Read More

ECHA, 21 April 2021

https://echa.europa.eu/-/nearly-300-chemicals-identified-as-candidates-for-regulatory-action

Mushroom

2021-04-30

https://parade.com/1193513/marynliles/science-jokes/

Cyclohexane

2021-04-30

Cyclohexane is a cycloalkane with the molecular formula $C_6H_{12.}$ [1] It is a colourless flammable liquid with a mild, sweet odour resembling that of chloroform or benzene that occurs naturally in crude oil, volcanic gases, and cigarette smoke but is also produced synthetically to be used as a solvent in numerous industries. [2,3]

USES[4]

This compound is used as a solvent to dissolve cellulose ethers, lacquers, resins, fats, waxes, oils, bitumen and crude rubber. It is also used in perfume manufacturing, during surface coating operations (lacquers), in synthesis of adipic acid for production of nylon 66 and engineering plastics, during synthesis of caprolactam in nylon 6, paint and varnish remover, in the extraction of essential oils, in analytical chemistry for molecular weight determinations, in the manufacturing of adipic acid, benzene, cyclohexyl chloride, nitrocyclohexane, cyclohexanol and cyclohexanone, in the manufacturing of solid fuel for camp stoves, in fungicidal formulations (possesses slight fungicidal action) in the industrial recrystallising of steroids, organic synthesis, recrystallising medium glass substitutes, solid fuels, in analytical chemistry and in manufacturing of adhesives.

Cyclohexane is a cycloalkane with the molecular formula C6H12.

SOURCES OF EMISSION & ROUTES OF EXPOSURE

Sources of Emission [4]

- Industry sources: The primary point sources are petroleum refining, automotive repair shops, and commercial printing and publishing.
- Diffuse sources: Sub-threshold facilities.
- Natural sources: Cyclohexane is a natural constituent of crude petroleum. It also occurs naturally as a plant volatile and can be released from volcanoes.
- Transport sources: Cyclohexane has been detected in motor vehicle exhaust.
- Consumer products: Cyclohexane is used as a solvent, oil extractant, paint and varnish remover, and in solid fuels.

Routes of Exposure [2,5]

Exposure to cyclohexane can occur through inhalation, ingestion, and eye or skin contact. Cyclohexane enters the body when breathed in with contaminated air or when consumed with contaminated food or water. It can also be absorbed through skin contact. Cyclohexane is not likely to remain in the body due to its breakdown and removal in exhaled air and in urine.

HEALTH EFFECTS [5]

The effects of cyclohexane on human health depend on how much of the chemical is present and the length and frequency of exposure. Effects also depend on the health of a person when exposure occurs. Breathing large amounts of cyclohexane for short periods of time adversely affects the human nervous system. Effects range from headaches to anaesthesia, tremors, and convulsions. Contact with cyclohexane liquid or vapour can damage the eyes. These effects are not likely to occur at levels of cyclohexane that are normally found in the environment. Human health effects associated with breathing or otherwise consuming smaller amounts of cyclohexane over long periods of time are not known. Information about cyclohexane's potential to cause cancer, developmental effects, or reproductive effects either does not exist or is not adequate. Studies show that repeat exposure to large amounts of cyclohexane in air causes nervous system effects, eye damage, and respiratory effects in animals. The cyclohexane industry is now studying how its chemical affects the reproductive system and the development of the foetus of animals.

SAFETY [6]

First Aid Measure

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Get medical attention.
- Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

CHEMWATCH
Bulletin Board
Hazard Alert
APR. 30, 2021

- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
- Ingestion: If swallowed, do NOT induce vomiting. Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Aspiration hazard if swallowed- can enter lungs and cause damage. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention. Get medical attention if symptoms appear.

Fire & Explosion Information

- Cyclohexane is highly flammable in presence of open flames and sparks, of heat. It is also slightly explosive in presence of open flames and sparks.
- Cyclohexane is insoluble in water. Dry chemical powder should be used to extinguish small fires. For large fires, use water spray or fog.
- Vapour may travel considerable distance to source of ignition and flash back.
- When mixed hot with liquid dinitrogen tetraoxide an explosion can result.

Exposure Controls & Personal Protection

Engineering Controls

When handling cyclohexane, exhaust ventilation or other engineering controls should be used to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protective Equipment

The following personal protective equipment should be used when handling cyclohexane:

- Splash goggles
- Lab coat

- Vapour respirator (be sure to use an approved/certified respirator or equivalent)
- Gloves

Personal Protection in Case of a Large Spill:

- Splash goggles
- Full suit
- Vapour respirator
- Boots
- Gloves
- A self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

REGULATION [2,7]

Occupational Exposure Limits

United States

- OSHA: The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for cyclohexane is 300 ppm (1050 milligrams per cubic metre (mg/m^3) as an 8-hour time-weighted average (TWA) concentration [29 CFR 1910.1000, Table Z-1].
- NIOSH: The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for cyclohexane of 300 ppm (1050 mg/m^3) as a TWA for up to a 10-hour workday and a 40-hour workweek [NIOSH 1992].
- ACGIH: The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned cyclohexane a threshold limit value (TLV) of 300 ppm (1030 mg/m^3) as a TWA for a normal 8-hour workday and a 40-hour workweek [ACGIH 1994, p. 17].

Australia

- Safe Work Australia: Safe Work Australia has established an 8-hour TWA for cyclohexane of 350 mg/m^3 and a short term exposure limit (STEL) of 1050 mg/m^3.

CHEMWATCH
Bulletin Board
Hazard Alert
APR. 30, 2021

REFERENCES

1. http://en.wikipedia.org/wiki/Cyclohexane
2. http://www.osha.gov/SLTC/healthguidelines/cyclohexane/recognition.html
3. http://toxipedia.org/display/toxipedia/Cyclohexane
4. http://www.npi.gov.au/substances/cyclohexane/index.html
5. http://www.epa.gov/chemfact/f_cycloh.txt
6. http://www.sciencelab.com/msds.php?msdsId=9927145
7. http://www.safeworkaustralia.gov.au/sites/swa/search/results?k=cyclohexane

Experimental drug boosts brain cell cleaning to reverse Alzheimer's disease symptoms in mice

2021-04-23

Researchers at Albert Einstein College of Medicine have designed an experimental drug that reversed key symptoms of Alzheimer's disease in mice. The drug works by reinvigorating a cellular cleaning mechanism—chaperone-mediated autophagy (CMA)—that gets rid of unwanted proteins by digesting and recycling them. "Discoveries in mice don't always translate to humans, especially in Alzheimer's disease," said co-study leader Ana Maria Cuervo, MD, PhD, the Robert and Renée Belfer Chair for the Study of Neurodegenerative Diseases, professor of developmental and molecular biology, and co-director of the Institute for Aging Research at Einstein. "But we were encouraged to find in our study that the drop-off in cellular cleaning that contributes to Alzheimer's in mice also occurs in people with the disease, suggesting that our drug may also work in humans."

The results reveal a dynamic interplay between CMA and Alzheimer's disease, with loss of CMA in neurons contributing to Alzheimer's, and vice versa. The findings suggest that drugs for revving up CMA may offer hope for treating neurodegenerative diseases.

Cuervo and colleagues report on their work in Cell, in a paper titled, "Chaperone-mediated autophagy prevents collapse of the neuronal metastable proteome."

All cells rely on intracellular surveillance systems to maintain proteome's homeostasis, or proteostasis—the cells' ability to regulate the proteins they contain—and age-related deficits in protein quality control in neurons can increase the risk of neurodegenerative diseases, the authors wrote.

In CMA, proteins called chaperones bind to damaged or defective proteins in cells of the body. The chaperones ferry their cargo to the cells' lysosomes—membrane-bound organelles filled with enzymes—which digest and recycle waste material. However, CMA becomes less efficient as people age, increasing the risk that unwanted proteins will accumulate into insoluble clumps that damage cells. Cuervo discovered the existence of CMA in the 1990, and has published 200 papers on its role in health and disease.

Alzheimer's disease and all other neurodegenerative diseases are characterized by the presence of toxic protein aggregates in patients'

The findings suggest that drugs for revving up CMA may offer hope for treating neurodegenerative diseases.

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

brains. "In fact, the presence of protein aggregates is a common feature in neurodegenerative patient brains," the authors noted. And even in the absence of neurodegenerative disease, most elderly brains display some protein aggregation.

For their reported studies, Cuervo and colleagues turned to rodent models to first investigate whether impaired CMA contributes to Alzheimer's disease. They genetically engineered a mouse to have excitatory brain neurons that lacked CMA. The absence of CMA in one type of brain cell was enough to cause short-term memory loss, impaired walking, and other problems often found in rodent models of Alzheimer's disease. In addition, the absence of CMA profoundly disrupted proteostasis. Proteins that were usually soluble had become insoluble and at risk for clumping into toxic aggregates.

Cuervo suspected that the converse was also true, and that early Alzheimer's disease might impair CMA. So the team then looked at a mouse model of early Alzheimer's disease in which brain neurons were made to produce defective copies of the protein tau. (Evidence indicates that abnormal copies of tau clump together to form neurofibrillary tangles that contribute to Alzheimer's disease.) The researchers focused on CMA activity within neurons of the hippocampus, the brain region that is crucial for memory and learning. They found that CMA activity in those neurons was significantly reduced in the Alzheimer's disease mice, compared with activity in the same neurons in control animals.

To investigate whether early Alzheimer's disease might block CMA in humans, the researchers then looked at single-cell RNA-sequencing data from neurons obtained postmortem from the brains of Alzheimer's disease patients, and from a comparison group of healthy individuals. The sequencing data revealed the level of CMA activity patients' brain tissue, and showed that while CMA activity was somewhat inhibited in the neurons of people who had been in the early stages of Alzheimer's, there was much greater CMA inhibition in the brains of people with advanced Alzheimer's.

"By the time people reach the age of 70 or 80, CMA activity has usually decreased by about 30% compared to when they were younger," said Cuervo. "Most peoples' brains can compensate for this decline. But if you add neurodegenerative disease to the mix, the effect on the normal protein makeup of brain neurons can be devastating. Our study shows that CMA deficiency interacts synergistically with Alzheimer's pathology to greatly accelerate disease progression."

Cuervo and her team have developed a novel drug that shows potential for treating Alzheimer's disease. "We know that CMA is capable of digesting defective tau and other proteins," said Cuervo. "But the sheer amount of defective protein in Alzheimer's and other neurodegenerative diseases overwhelms CMA and essentially cripples it. Our drug revitalizes CMA efficiency by boosting levels of a key CMA component."

In CMA, proteins called chaperones bind to damaged or defective proteins in cells of the body. The chaperones ferry their cargo to the cells' lysosomes—membrane-bound organelles filled with enzymes—which digest and recycle waste material. To successfully get their cargo into protein-digesting lysosomes, chaperones must first "dock" the material onto a membrane-bound protein receptor called LAMP2A (lysosome-associated membrane protein type 2A; L2A). The more LAMP2A receptors there are on lysosomes, the greater the level of CMA activity that is possible. The new drug, called CA, works by increasing the number of those LAMP2A receptors. The drug was designed by co-study lead Evripidis Gavathiotis, PhD, professor of biochemistry and of medicine.

"You produce the same amount of LAMP2A receptors throughout life," Cuervo explained. "But those receptors deteriorate more quickly as you age, so older people tend to have less of them available for delivering unwanted proteins into lysosomes. CA restores LAMP2A to youthful levels, enabling CMA to get rid of tau and other defective proteins so they can't form those toxic protein clumps."

Interestingly, earlier this month Cuervo's team reported that, for the first time, they had isolated lysosomes from the brains of Alzheimer's disease patients and observed that reduction in the number of LAMP2 receptors causes loss of CMA in humans, just as it does in animal models of Alzheimer's.

Through their studies now reported in Cell, the researchers tested CA in two different mouse models of Alzheimer's disease. In both disease mouse models, oral doses of CA administered over 4–6 months led to improvements in memory, depression, and anxiety, such that the treated animals resembled or closely resembled healthy, control mice. Walking ability significantly improved in the animal model in which it was a problem. The drug also significantly reduced levels of tau protein and protein clumps in the brain neurons of both animal models, compared with the neurons of untreated animals.

"Importantly, animals in both models were already showing symptoms of disease, and their neurons were clogged with toxic proteins before the

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

drugs were administered," Cuervo pointed out. "This means that the drug may help preserve neuron function even in the later stages of disease." The scientists further stated, "Even at a symptomatic stage, activation of CMA led to strikingly reduced ß-amyloid and tau pathologies as well as glial activation."

The authors stated, "… we demonstrate that chemical upregulation of CMA in two different mouse models of AD, with tau pathology or combined tau and ß-amyloid pathologies, reduces brain pathology and improves disease phenotype… our results highlight that pharmacological CMA activation using a clinically relevant design has a beneficial effect on AD-related pathology."

Encouragingly, treatment with CA did not appear to harm other organs even when given daily for extended periods of time. Cuervo continued, "We were also very excited that the drug significantly reduced gliosis—the inflammation and scarring of cells surrounding brain neurons. Gliosis is associated with toxic proteins and is known to play a major role in perpetuating and worsening neurodegenerative diseases."

The team concluded, "Our findings highlight the contribution of CMA to neuronal proteostasis, demonstrate that CMA deficiency in the aging brain is an aggravating factor in the onset of neurodegenerative diseases, and provide proof of concept for the value of targeting CMA as therapeutic strategy in these conditions." Cuervo and Gavathiotis have teamed up with Life Biosciences of Boston, Massachusetts, to find Selphagy Therapeutics, which is currently developing CA and related compounds for treating Alzheimer's and other neurodegenerative diseases.

genengnews.com, 23 April 2021

https://www.genengnews.com

Silver coins unearthed in New England may be loot from one of the 'greatest crimes in history'

2021-04-23

A handful of Arabian silver coins found in New England may be the last surviving relics of history's most notorious act of piracy — and perhaps one of the most famous pirates who ever lived.

Evidence suggests the distinctive coins were spent as common silver in the American colonies in the late 1690s by the fugitive pirate crew of Henry Every, also known as John Avery, who had fled there after plundering the

Their discovery has also cast new light on Every's whereabouts shortly before he vanished with his loot.

Mughal treasure ship Ganj-i-sawai as it was returning pilgrims from the Muslim Hajj.

Researchers aren't certain that the coins are from the Ganj-i-sawai, but their origin, their dates and their discovery in such a distant region suggest they were seized by the pirates and spent in the Americas.

The coins may have been handled by Every himself, who disappeared a few years later but who came to be portrayed as an almost heroic figure from what some have called the "Golden Age of Piracy."

Their discovery has also cast new light on Every's whereabouts shortly before he vanished with his loot. "We can prove beyond a doubt that he actually was in the mainland American colonies," Rhode Island metal detectorist Jim Bailey told Live Science.

Bailey found one of the first of the Arabian silver coins, called a comassee, in 2014 at the site of a colonial settlement on Aquidneck Island, about 20 miles (32 kilometers) south of Providence.

More than a dozen similar coins thought to be from the pirate raid on the Ganj-i-sawai have now been discovered by metal detectorists and archaeologists elsewhere in Rhode Island, and in Massachusetts, Connecticut and North Carolina — maybe the last evidence of one of the greatest crimes in history.

Pirate attack

In 1695, Every and his cutthroat crew on board their ship Fancy joined a pirate raid on a convoy in the Red Sea that was returning to India from Mecca.

Every's ship chased and caught the convoy's flagship, the Ganj-i-sawai, which belonged to the Grand Mughal Aurangzeb, the Muslim emperor of what is now India and Pakistan. Reports say the pirates tortured and killed its crew and 600 passengers, before making off with gold and silver, including thousands of coins, said to be worth between 200,000 and 600,000 British pounds — the equivalent of between $40 million and $130 million in today's money.

After an outcry led by the British East India Company, whose profits on the riches of India were threatened by the raid, Britain's King William III ordered what is regarded as the first international manhunt to capture Every and the other pirates.

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

By this time, however, Every and his crew had escaped to the New World. They lived for several months in the Bahamas, possibly with the collusion of the British governor of the islands; but they fled in late 1696 as the Royal Navy closed in.

Some of Every's crew went to live in the mainland colonies, where they were eventually tried and acquitted, possibly as a result of bribery; but there were no further sightings of Every. Later reports suggested he had sailed to Ireland while still on the run and that he died there, impoverished, a few years later. Since his loot from the Ganj-i-sawai was never accounted for, rumors long persisted that the treasure had been buried somewhere in secret.

Arabian silver

Bailey is an amateur archaeologist who worked on the recovery of the wreck of the Whydah, a pirate ship discovered off Cape Cod in 1984.

In 2014, his metal detector picked up the first of the mysterious coins in a meadow on Aquidneck Island that was once the site of a colonial township.

"You never field-clean a coin, because you could damage it," he said. "I had to run to my car and get a big bottle of water… the mud came off, and I saw this Arabic script on the coin and I was amazed, because I knew exactly where it'd come from," he said. "I was aware that the American colonies had been bases of operation for piracy in the late 17th century."

Studies of the Arabic writing on the coin showed it had been minted in Yemen in southern Arabia in 1693, just a few years before the pirate attack on the Ganj-i-sawai. Another 13 have been found, mostly by metal detectorists, but the latest in 2018 by archaeologists in Connecticut; two Ottoman Turkish silver coins thought to be from the same hoard have also been unearthed in the region.

Bailey has carefully studied each of the discoveries, while researching historical sources about the pirates who might have brought the coins to the Americas; and in 2017, some of his work was published in the Colonial Newsletter, a research journal published by the American Numismatic Society.

Several of the coins show the year they were minted, while some are marked with the names of rulers at the time, which can be used to date them. "None of the coins date after 1695, when the Ganj-i-sawai was captured," Bailey said.

Pirate treasure

Every is thought to have sailed directly to Ireland after his time in the Bahamas, but Bailey's research suggests Every first spent several weeks on the American mainland, trading in African slaves he had bought with the loot from the Ganj-i-sawai.

Historical records relate that a ship Every had acquired in the Bahamas, Sea Flower, sold dozens of slaves on the mainland, and Bailey's research suggests that Every was on board, he said.

Bailey thinks Every probably died in Ireland eventually, as described by some chroniclers. But others portrayed him as a swashbuckling "king" who ruled for years over a fictional pirate utopia in Madagascar.

There's no way to know if Every handled the New England coins himself, but Bailey thinks they were almost certainly part of the hoard looted from the Mughal ship (Some coin specialists, however, are not convinced by his theory.)

While most of the loot was probably melted down to hide the origins, "what we're finding basically are the coins that were being used by the pirates when they were on the run: coins for lodgings, coins for meals, coins for drinking," he said.

Astonishingly, the coins may also have been referred to in the manhunt proclamation by King William, which stated that Every and the other fugitives had looted many "Indian and Persian" gold and silver coins from the captured ship.

"How often do you find a coin that's mentioned in the proclamation for the capture of a pirate and the subject of the first worldwide manhunt?" Bailey said. "It's just fantastic."

Originally published on Live Science.

livescience.com, 23 April 2021

https://www.livescience.com

With lawsuits against paraquat manufacturers already filed in multiple states, attorneys are now investigating paraquat lawsuit cases at no charge.

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

Paraquat exposure alert: Paraquat linked to Parkinson's disease—agricultural workers could be entitled to compensation

2021-04-15

Agricultural workers who were exposed to the herbicide paraquat and have been diagnosed with Parkinson's disease may have a claim for financial compensation.

With lawsuits against paraquat manufacturers already filed in multiple states, attorneys are now investigating paraquat lawsuit cases at no charge.

A paraquat toxic exposure lawsuit may be your only chance to receive the compensation you need to cover the costs of treating Parkinson's disease.

What You Need to Know About Paraquat and Parkinson's Disease

Dozens of countries around the world have banned the use of paraquat, a weed killer so toxic that ingesting a single sip can be deadly, according to The New York Times.

In the United States, paraquat use isn't just legal—it's on the rise. The total amount of paraquat usage in the U.S. doubled between 2006 and 2016, the National Water-Quality Assessment (NAWQA) Project reported.

That increase in usage translates to an increase in exposure to paraquat and to the harms linked to the toxic chemical. Numerous research studies have shown that, besides posing a risk of potentially deadly paraquat poisoning, the herbicide can increase your risk of developing Parkinson's disease.

The American Journal of Epidemiology, JAMA (Journal of the American Medical Association) Neurology, and the National Institute of Environmental Health Sciences are just a few of the sources that have published research pointing to a link between paraquat and Parkinson's disease.

The Unified Parkinson's Advocacy Council submitted a letter to the Environmental Protection Agency (EPA) in which it noted, "Recent research links paraquat and several other herbicides to the development of Parkinson's pathology and symptoms." In the letter, the Unified Parkinson's Advocacy Council urged the EPA to ban the use of the herbicide in the U.S., which, as of April 2021, the agency has not done.

The first lawsuits against paraquat manufacturers pertaining to the Parkinson's disease risk were filed in October 2017 in Illinois. Farmers and agriculture workers in other states have since commenced legal action to hold the makers of the herbicide accountable, Bloomberg reported.

Paraquat Herbicide Lawsuit FAQs

What Is Paraquat Herbicide?

Paraquat is a fast-acting, non-selective contact weed killer. One of the most popular herbicides containing paraquat in the United States is Gramoxone SL 2.0 Herbicide, manufactured by Syngenta.

Other paraquat herbicide trade names include:

- Para-SHOT
- Helmquat
- Parazone
- Firestorm
- Ortho-Paraquat
- Quick-Quat
- Devour
- Blanco

The paraquat manufacturers named in lawsuits so far include Syngenta, Growmark, and Chevron U.S.A, Inc.

Is Paraquat in Roundup?

No, paraquat is not the active ingredient found in Roundup. While the herbicide Roundup has also been the subject of lawsuits—more than 125,000 of them—in recent years, the active ingredients and the specific health risks associated with these chemicals are different.

The makers of herbicides containing paraquat are facing lawsuits over the link between the toxic chemical and Parkinson's Disease. Monsanto, the company that first made Roundup, and Bayer, the parent company that now owns Monsanto, are facing lawsuits over evidence of a link between cancer and the active ingredient in Roundup.

What Is Parkinson's Disease?

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

Parkinson's disease is a neurodegenerative disorder in which nerve cells in a part of the brain called the substantia nigra don't produce enough of the neurotransmitter dopamine, according to the Parkinson's Foundation. Not having enough dopamine is what causes the movement symptoms that distinguish Parkinson's disease, including tremors, limb rigidity, and gait problems.

Although it is a movement disorder, Parkinson's disease can bring about non-movement symptoms that include cognitive impairment, depression, sleep disorders, and constipation, according to the Parkinson's Foundation.

Parkinson's disease is a progressive disorder. This means the disease gets worse over time. Although Parkinson's disease is incurable, its symptoms are treatable. Data from some clinical research trials suggest that there is hope to slow Parkinson's disease progression through early intervention, although there's not enough data to "conclusively demonstrate" that this is possible, according to The American Journal of Managed Care.

What Should I Know If I'm Considering a Paraquat Lawsuit?

If you're thinking of joining a paraquat lawsuit, here's what you need to know:

- You may be able to seek compensation for all of your damages, including medical costs, lost wages, pain and suffering, and declines in your quality of life.
- There are deadlines to file toxic exposure lawsuits and in-depth investigations that must be performed, so the sooner you get started, the better.
- You will need the help of an experienced paraquat lawsuit lawyer to prove that exposure to the herbicide is what caused you to develop Parkinson's disease.
- It costs you nothing out of pocket to get started with a claim. The consultation is free, and legal representation is offered on a no-win, no-fee basis.

For licensed applicators and other agricultural workers who developed Parkinson's disease after being exposed to paraquat, getting financial

But over 20 years, the population has declined by an estimated 89%.

compensation will help you afford the best care. That, in turn, will help you have the best quality of life.

natlawreview.com, 15 April 2021

https://www.natlawreview.com

Ingredients in Roundup not tested by the EPA could be killing bumblebees

2021-04-23

The American bumblebee used to be one of the most commonly observed bees in the country. But over 20 years, the population has declined by an estimated 89%.

One of the challenges the bees face may be the growing use of Roundup, the wildly popular weedkiller that, until recently, wasn't thought to be a major threat to bees. Glyphosate, the active ingredient in the herbicide and a registered pesticide, has been linked to cancer in humans, and banned in some countries. (The EPA maintains that it is "unlikely to be a human carcinogen.") When the EPA tested the safety of glyphosate for insects by spraying it on honeybees, they found that it wasn't a concern. But when a recent independent study tested Roundup products, scientists discovered that the other ingredients in the spray—none of which are tested by the EPA—were toxic to bumblebees.

"The way that the current pesticide law's written, only the active ingredient is the one that's looked into in-depth as far as its toxicity," says Jess Tyler, an entomologist and staff scientist at the nonprofit Center for Biological Diversity. Other chemical additives used along with glyphosate, "co-formulants" designed to make glyphosate more effective, are considered "inert" and don't get tested. If you buy a bottle of Roundup at Home Depot, the label won't list these other ingredients.

In the recent study, published in the Journal of Applied Ecology, researchers at Royal Holloway University of London tested four common herbicides—Roundup Ready-To-Use, Roundup No Glyphosate, Roundup ProActive, and a competitor's product, Weedol, which also uses glyphosate. They sprayed the products directly onto more than 50 bees of a bumblebee species common in Europe. Weedol didn't produce significant mortality. The Roundup product made without glyphosate, on the other hand, killed 96% of the bees. Roundup Ready-To-Use killed 94%; the other Roundup product, commonly used in agriculture, killed 30%.

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

Bayer, which acquired Roundup manufacturer Monsanto in 2018, contested the study's methodology, saying in a statement it was "inconsistent with product instructions and common sense about where to spray weed killers." Roundup instructions, however, don't warn users not to spray when bees are present. (The instructions for one of the tested products say that it "is of low toxicity to honeybees; there is no requirement to avoid application of the product when bees are foraging on flowering weeds in treated crops.") "While it is common sense that you should avoid spraying any pesticide where bees are present, the information which accompanies Bayer's products directly contradicts this," says study lead author Edward Straw, a PhD candidate at Royal Holloway University of London. "Changing label restrictions to disallow spraying when bees are present would reflect the potential threat to pollinators herbicides pose."

Bayer also took issue with the fact that the study did not include a control for soapy water, which could kill bees, since "weed killers typically contain a herbicide that kills the weeds, water, and a surfactant that acts like soap to spread the herbicide on weed leaves and reduce the amount of herbicide needed." But if surfactants are dangerous to bees, and Roundup contains surfactants, it follows that Roundup is also dangerous to bees. The researchers did not test the specific surfactants in the formulas because those ingredients are a trade secret.

Bumblebees are facing other threats, too, like climate change along with loss of habitat. In the U.S., native bees face competition from non-native honeybees. Insecticides are yet another problem. "I don't think there's any coincidence that the rise in the class of insecticides called neonicotinoids, which you've probably heard of, has really ramped up in the last 20 years…and that these bees have gone down now," Tyler says. Pesticides weaken the bees' immune system and make them more susceptible to some diseases. The U.K. researchers hypothesize that Roundup may kill bees because the problematic ingredients fill tiny holes in their thorax and abdomen that insects use to breathe.

Though the study looked at one species of bumblebee, Bombus terrestris audax, it's likely that the products could also kill other bees. And bumblebees, in particular, need all of the help they can get: Out of 46 species of bumblebees in North America, the International Union for the Conservation of Nature has found that 12 are headed towards extinction. Another recent study found that bumblebee populations in the U.S. have dropped nearly 50% in a generation.

Regulators need to study products like this differently, says Tyler, and look at the impact of the final product rather than just the "active" ingredient. "These other ingredients can have effects that are not really accounted for in the risk assessment when these things are put out on the market," he says. It's possible that some of the products could be fairly easily redesigned to reduce the risk—since Weedol didn't appear to kill bees, even with a high exposure, it's proof that a different formula could help.

fastcompany.com, 23 April 2021

https://www.fastcompany.com

Dolphins learn the 'names' of their friends to form teams—a first in animal kingdom

2021-04-22

Like members of a street gang, male dolphins summon their buddies when it comes time to raid and pillage—or, in their case, to capture and defend females in heat. A new study reveals they do this by learning the "names," or signature whistles, of their closest allies—sometimes more than a dozen animals—and remembering who consistently cooperated with them in the past. The findings indicate dolphins have a concept of team membership—previously seen only in humans—and may help reveal how they maintain such intricate and tight-knit societies.

"It is a ground-breaking study," says Luke Rendell, a behavioral ecologist at the University of St. Andrews who was not involved with the research. The work adds evidence to the idea that dolphins evolved large brains to navigate their complex social environments.

Male dolphins typically cooperate as a pair or trio, in what researchers call a "first-order alliance." These small groups work together to find and corral a fertile female. Males also cooperate in second-order alliances comprised of as many as 14 dolphins; these defend against rival groups attempting to steal the female. Some second-order alliances join together in even larger third-order alliances, providing males in these groups with even better chances of having allies nearby should rivals attack.

Dolphins often switch partners in their first-order alliances, but they maintain the allies in the second-order groups for decades, according to long-term behavioral studies at Shark Bay in Western Australia. These groups are considered the core unit of the males' society. The males "stay together for their lifetimes," at least as long as 40 years, notes Stephanie King, a behavioral biologist at the University of Bristol.

"It is a ground-breaking study," says Luke Rendell, a behavioral ecologist at the University of St. Andrews who was not involved with the research.

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

But how do the males keep track of everyone in these complex groups?

Scientists have argued that their whistles are key. Every dolphin learns a unique signature whistle from its mother, which it keeps for life; dolphins recognize and remember each others' whistles, similar to how we recognize each other's names.

To further investigate how the male dolphins use their whistles, King and her colleagues turned to a population of Indo-Pacific bottlenose dolphins (Tursiops aduncus) living in the remarkably clear waters of Shark Bay. The team has tracked the animals with an array of underwater microphones since 2016, enabling them to identify which dolphin produces which whistle.

From 2018 to 2019, the researchers placed a speaker underwater and played the whistles of males to other males in their various alliances. These males ranged in age from 28 to 40 years old, and had been in these groups their entire lives. Meanwhile, the scientists flew a drone overhead to film the dolphins' responses.

The researchers expected that males hearing the whistle of their first-order alliance partners would respond most strongly. But when they reviewed the videos, they found the strongest responses came from males in the dolphins' second-order alliances—animals who had a steadfast cooperative history of fighting off attackers with them (as seen in the video above), they report today in Nature Communications.

"It was so striking," says King, lead author of the study. "In 90% of experiments, dolphins who heard whistles of second-order alliance members turned immediately and directly toward the speaker." The findings, she says, suggest dolphins—like humans—have a "social concept of team membership, based on an individual's previous cooperative investment, rather than how good friends they are."

This "paper provides the missing link" between the male dolphins' signature whistles and their cooperative alliances, says Frants Jensen, a behavioral ecologist at the Woods Hole Oceanographic Institution who was not involved with the work. Jensen and others predict the researchers' high-tech approach will help scientists unlock other mysteries of cetacean communication.

In the past few years, we've seen these microplastics turn up in Antarctic sea ice, near the summit of Mt Everest, in snowfall in the Arctic, and in human stool samples collected all around the world.

For example, dolphin females whistle, too. What are they talking about?

sciencemag.org, 22 April 2021

https://www.sciencemag.org

Microplastics found to alter shape and de-cluster human lung cells

2021-04-19

A growing body of research has started to illuminate the widespread impacts of plastic pollution, and the downstream effects of it on the environment and human health. A new study has delved into the kind of damage microplastics can cause to human lungs, with researchers observing changes to the shape of lung cells and a slowdown in their metabolism when exposed to these tiny plastic particles.

The research was carried out at Florida State University (FSU) and focuses on small fragments of plastic waste that have broken down in the environment. In the past few years, we've seen these microplastics turn up in Antarctic sea ice, near the summit of Mt Everest, in snowfall in the Arctic, and in human stool samples collected all around the world.

At the same time, scientists have started to investigate how these tiny particles can impact the health of various organisms, with studies finding they can cause aneurysms in fish, impair shell selection in hermit crabs and build up in plants to stunt their growth. The World Health Organization also launched a health review into the microplastics in bottled drinking water, while in separate but related research last week, plasticizers used in BPA-like plastics were found to likely cause alarming damage to brain cells.

For this latest study, the FSU team set out to investigate the health risks of inhaling and ingesting these small particles, by carrying out experiments on human lung cells in a Petri dish that were subjected to environmental concentrations of polystyrene particles. After only a few days, the scientist began to observe some strange changes take pace, finding that the plastic particles caused the cells' metabolism to slow down and hampered their proliferation and growth.

"Microplastics didn't kill the cells, but the cells were definitely not acting normal," says study author Kerestin Goodman.

The plastics also caused the lung cells to decluster, which created gaps in what would normally be a continuous, solid sheet of cells. Additionally, the

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

team found that the particles were actually taken up by the cells to form a ring around the nucleus in the cell.

"We saw this attraction to the nucleus happening after only 24 hours and so now we really want to look at why are these pieces going there and what's happening once they get there," says Goodman.

Exploring these effects on the nucleus is one of the goals of the research team moving forward, along with exploring what the long-term health effects could be for people with respiratory conditions. They note that one of the shortcomings of the study was that the experiments didn't directly replicate the process of breathing these particles in and out, with the particles instead directly exposed to the cells in a liquid solution. Nonetheless, the results raise interesting questions for further study.

"We don't want to overstate the harmful effects of microplastics on human health," says study author Qing-Xiang "Amy" Sang. "The reason plastics are widely used is because they're good materials for industry, construction, medical and research supplies, and consumer products. But there may be some long-term undesirable effects that could be especially detrimental to growing babies and people with lung diseases. We need to investigate so we have a better understanding of the potential cost to human health."

The research was published in the journal Chemical Research in Toxicology.

newatlas.com, 19 April 2021

https://www.newatlas.com

'Undruggable' cancer protein becomes druggable, thanks to shrub

2021-04-20

A chemist from Purdue University has found a way to synthesize a compound to fight a previously "undruggable" cancer protein with benefits across a myriad of cancer types.

Inspired by a rare compound found in a shrub native to North America, Mingji Dai, professor of chemistry and a scientist at the Purdue University Center for Cancer Research, studied the compound and discovered a cost-effective and efficient way to synthesize it in the lab. The compound—curcusone D—has the potential to help combat a protein found in many cancers, including some forms of breast, brain, colorectal, prostate, lung and liver cancers, among others. The protein, dubbed BRAT1, had

The compound—curcusone D—has the potential to help combat a protein found in many cancers, including some forms of breast, brain, colorectal, prostate, lung and liver cancers, among others.

previously been deemed "undruggable" for its chemical properties. In collaboration with Alexander Adibekian's group at the Scripps Research Institute, they linked curcusone D to BRAT1 and validated curcusone D as the first BRAT1 inhibitor.

Curcusones are compounds that come from a shrub named Jatropha curcas, also called the purging nut. Native to the Americas, it has spread to other continents, including Africa and Asia. The plant has long been used for medicinal properties—including the treatment of cancer—as well as being a proposed inexpensive source of biodiesel.

Dai was interested in this family of compounds—curcusone A, B, C and D.

"We were very interested by these compounds' novel structure," Dai said. "We were intrigued by their biological function; they showed quite potent anti-cancer activity and may lead to new mechanisms to combat cancer."

Researchers tested the compounds on breast cancer cells and found curcusone D to be extremely effective at shutting down cancer cells. The protein they were targeting, BRAT1, regulates DNA damage response and DNA repair in cancer cells. Cancer cells grow very fast and make a lot of DNA. If scientists can damage cancer cells' DNA and keep them from repairing it, they can stop cancer cells from growing.

"Our compound can not only kill these cancer cells, it can stop their migration," Dai said. "If we can keep the cancer from metastasizing, the patient can live longer."

Stopping cancer from spreading throughout the body—metastasizing—is key to preserving a cancer patient's life. Once cancer starts to migrate from its original organ into different body systems, new symptoms start to develop, often threatening the patient's life.

"For killing cancer cells and stopping migration, there are other compounds that do that," Dai said. "But as far as inhibiting the BRAT1 protein, there are no other compounds that can do that."

Dai and his team believe that as effective as curcusone D is by itself, it may be even more potent as part of a combination therapy. They tested it alongside a DNA damaging agent that has already been approved by the Food and Drug Administration and found that this combination therapy is much more effective.

One difficulty in studying curcusones as potential cancer treatments is that, while the shrub they come from is common and inexpensive, it

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

takes massive amounts of the shrub to yield even a small amount of the compounds. Even then, it is difficult to separate the compounds they were interested in from the rest of the chemicals in the shrub's roots.

"In nature, the plant doesn't produce a lot of this compound," Dai said. "You would need maybe as much as 100 pounds of the plant's dry roots to get just about a quarter teaspoon of the substance—a 0.002% yield."

That small yield is relevant for production, because if it is effective as a cancer treatment, pharmacists will need a lot more of it. Additionally, having an abundant supply of the compounds makes studying them easier, quicker and less expensive.

"That's why a new synthesis is so important," Dai said. "We can use the synthesis to produce more compounds in a purer form for biological study, allowing us to advance the field. From there, we can make analogs of the compound to improve its potency and decrease the potential for side effects."

The next step will be to test the compound to ensure that it is not toxic to humans, something the researchers are optimistic about since the shrub it came from has been used as a traditional medicine in a number of cultures. Already, researchers from other entities have reached out to test the compound on the cancers they study, bringing hope for renewed therapeutics for treating the disease.

"Many of our most successful cancer drugs have come from nature," Dai said. "A lot of the low-hanging fruit, the compounds that are easy to isolate or synthesize, have already been screened and picked over. We are looking for things no one has thought about before. Once we have the chemistry, we can build the molecules we're interested in and study their biological function."

phys.org, 20 April 2021

https://www.phys.org

Nuclear fallout is showing up in U.S. honey, decades after bomb tests

2021-04-20

Fallout from nuclear bomb tests in the 1950s and '60s is showing up in U.S. honey, according to a new study. Although the levels of radioactivity aren't dangerous, they may have been much higher in the 1970s and '80s, researchers say.

The study, he says, shows that the fallout "is still out there and disguising itself as a major nutrient."

"It's really quite incredible," says Daniel Richter, a soil scientist at Duke University not involved with the work. The study, he says, shows that the fallout "is still out there and disguising itself as a major nutrient."

In the wake of World War II, the United States, the former Soviet Union, and other countries detonated hundreds of nuclear warheads in aboveground tests. The bombs ejected radiocesium—a radioactive form of the element cesium—into the upper atmosphere, and winds dispersed it around the world before it fell out of the skies in microscopic particles. The spread wasn't uniform, however. For example, far more fallout dusted the U.S. east coast, thanks to regional wind and rainfall patterns.

Radiocesium is soluble in water, and plants can mistake it for potassium, a vital nutrient that shares similar chemical properties. To see whether plants continue to take up this nuclear contaminant, James Kaste, a geologist at the College of William & Mary in Williamsburg, Virginia, gave his undergraduate students an assignment: Bring back local foods from their spring break destinations to test for radiocesium.

One student returned with honey from Raleigh, North Carolina. To Kaste's surprise, it contained cesium levels 100 times higher than the rest of the collected foods. He wondered whether eastern U.S. bees gathering nectar from plants and turning it into honey were concentrating radiocesium from the bomb tests.

So Kaste and his colleagues—including one of his undergrads—collected 122 samples of locally produced, raw honey from across the eastern United States and tested them for radiocesium. They detected it in 68 of the samples, at levels above 0.03 becquerels per kilogram—roughly 870,000 radiocesium atoms per tablespoon. The highest levels of radioactivity occurred in a Florida sample—19.1 becquerels per kilogram.

The findings, reported last month in Nature Communications, reveal that, thousands of kilometers from the nearest bomb site and more than 50 years after the bombs fell, radioactive fallout is still cycling through plants and animals.

Still, those numbers are nothing to fret about, the U.S. Food and Drug Administration tells Science. The radiocesium levels reported in the new study fall "well below" 1200 becquerels per kilogram—the cutoff for any food safety concerns, the agency says.

"I'm not worried at all," Kaste adds. "I eat more honey now than I did before I started the project. And I have kids, I feed them honey."

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

Radiocesium decays over time, so honey in the past probably contained more of it. To find out how much more, Kaste's team pored through records of cesium testing in U.S. milk—which was monitored out of concern for radiation contamination—and analyzed archived plant samples.

In both data sets, the researchers found that radiocesium levels had declined sharply since the 1960s—a similar trend that likely occurred in honey. "Cesium levels in honey were probably 10 times higher in the 1970s," Kaste speculates. "Because of radioactive decay, what we're measuring today is only a whiff of what was there before."

The findings raise questions about how cesium has impacted bees over the past half-century, says Justin Richardson, a biogeochemist at the University of Massachusetts, Amherst. "They're getting wiped out from pesticides, but there are other lesser known toxic impacts from humans, like fallout, that can affect their survival."

After the Chernobyl nuclear disaster in 1986, scientists showed radiation levels nearby could hamper the reproduction of bumble bee colonies. But those levels were 1000 times higher than the modern levels reported here, notes Nick Beresford, a radioecologist at the U.K. Centre for Ecology & Hydrology.

So even though the new study shouldn't raise any alarm bells over today's honey, understanding how nuclear contaminants move around is still vital for gauging the health of our ecosystems and our agriculture, says Thure Cerling, a geologist at the University of Utah. "We need to pay attention to these things."

sciencemag.org, 20 April 2021

https://www.sciencemag.org

Woman mistakes nail glue for eye drops, glues eye shut

2021-04-23

A woman in Michigan accidentally glued her eye shut when she mixed up her bottles of eye drops and nail glue, according to news reports.

The woman, Yacedrah Williams, said she had gone to sleep with her contact lenses in, but woke up at 1 a.m. and wanted to take them out, according to local news outlet WXYZ in Detroit. Since her eyes were dry, she needed some eye drops to help remove the lenses.

"I just started throwing cold water [on it], and I was trying to pull my eyes apart but couldn't."

So she reached for her purse, where she kept a small bottle of eye drops. But she also stored a small bottle of nail glue in her purse, for fixing broken fingernails, WXYZ reported.

Williams realized her mistake a second too late. "I was like, 'Oh my goodness.' It dropped in my eye, and I tried to wipe it away. It sealed my eye shut," Williams told WXYZ. "I just started throwing cold water [on it], and I was trying to pull my eyes apart but couldn't."

Williams' decision to put water in her eye turned out to be a good one. "If you ever get anything in your eye, the immediate thing to do is try and flush your eye out" by holding your head under a faucet or pouring a bottle of water over your eye, Dr. George Williams, an ophthalmologist at Beaumont Health in Royal Oak, Michigan, told WXYZ. "You'll make a mess but you may save your vision."

He added that Yacedrah Williams is not the first person to accidentally put nail glue in her eye.

Williams was taken to the hospital where doctors removed her contact lens, which had the nail glue on it. "They said that contact saved my vision," Yacedrah Williams said. She lost her eye lashes on that eye because doctors had to flip the top of the eyelid and pull on it to remove the lens, she said.

Yacedrah Williams added that she'll never keep eye drops and nail glue together in her purse again, and she likely won't use nail glue anymore.

Originally published on Live Science.

livescience.com, 23 April 2021

https://www.livescience.com

Just 19% of Earth's land is still 'wild,' analysis suggests

2021-04-19

Since the 1960s, conservationists have had a standard solution for saving biodiversity: Protect natural areas from human influence. But a new analysis of Earth's land use going back 12,000 years suggests that even in the time of mammoths and giant sloths, just one-quarter of the planet was untouched by humans, compared with 19% today. Because some of those inhabited areas are now biodiversity hot spots, people probably helped sustain—and even increase—the diversity of other species for millennia,

If their practices are sustainable, "humans don't have to be removed," to save the world's species.

CHEMWATCH
Bulletin Board
Gossip
APR. 30, 2021

the authors write. The findings also suggest many traditional practices and Indigenous peoples play a key role in preserving biodiversity.

The paper "debunks an important myth" in conservation circles, says Massachusetts Institute of Technology aerospace engineer Danielle Wood, who studies technology and international development but was not involved with the new work. By offering a long-term look at humans' impact on the planet, the study reveals that it's not people per se that send biodiversity on a downward spiral, but it's instead the overexploitation of resources, she explains. If their practices are sustainable, "humans don't have to be removed," to save the world's species.

To find out how human habitation has impacted biodiversity, a multidisciplinary team of researchers from several universities refined a model for predicting past land use. The model starts with maps of current land use patterns—the locations of rangelands, agricultural lands, cities, and mines—and incorporates census data about past and present population sizes. It then works backward, adding archaeological data to predict land use at 60 points in time over the past 12,000 years. On the resulting maps, the researchers overlay current data about vertebrate biodiversity, threatened species, and protected areas, as well as government-recognized Indigenous areas.

They found that humans had spread across almost three-quarters of Earth, excluding Antarctica, by 12,000 years ago, occupying great swaths of what conservationists now call "natural," "intact," or "wild" lands. Ten thousand years ago, the true extent of such untouched lands was 27%; now, it is 19%, the researchers report today in the Proceedings of the National Academy of Sciences. But even more provocatively, the team found statistical associations between current biodiversity hot spots and past land use suggesting that ancient people played a role in preserving, or even creating, these hot spots, including the Amazon and the Congo.

The results "illustrate the fallacy of the concept of 'pristine' nature untouched by human hands," says Ruth DeFries, a sustainability scientist at Columbia University who was not involved with the study.

Yet they also show some recent dramatic changes. For example, land use remained fairly stable for much of the past 12,000 years, but began to shift radically from the 1800s through about 1950. Those changes include the familiar modern threats of intensive agriculture, urbanization, large-scale mining, and deforestation.

The findings come as no surprise to anthropologists and archaeologists, who know that humans have been managing natural landscapes for millennia—by burning forests and planting fields, for example. But the paper "adds to a growing cry by some rights groups and conservation organizations that Indigenous communities should be in control of biodiversity hot spots," says Dana Lepofsky, an archaeologist and ethnoecologist at Simon Fraser University. Fiore Longo, head of the conservation campaign for the Indigenous rights group Survival International, agrees. "This paper confirms what we've been saying for years," she says. "Wilderness is a colonial and racist myth with no basis in science," that has often been used to justify the theft of Indigenous lands.

Anthropologists note that not every Indigenous group in history has sustained biodiversity. Ancient people likely helped drive to extinction megafauna like mammoths and flightless Pacific island birds, for example. But, "There is no question [that] Indigenous people have been much better stewards of nature than the rest of us," says Eric Dinerstein, a conservation biologist at the Washington, D.C., sustainability nonprofit RESOLVE. "The single most important thing we can do is empower and finance Indigenous peoples to conserve their sovereign lands."

sciencemag.org, 19 April 2021

https://www.sciencemag.org

Why Bitcoin is bad for the environment

2021-04-22

Money, it's often said, is a shared fiction. I give you a slip of paper or, more likely these days, a piece of plastic. You hand me eggs or butter or a White Chocolate Mocha Frappuccino, and we both walk away satisfied. With cryptocurrency, the arrangement is more like a shared metafiction, and the instability of the genre is, presumably, part of the thrill. Dogecoin, a cryptocurrency that was created as a spoof, has risen in value by eight thousand per cent since January, owing to a combination of GameStop-style pumping and boosterish tweets from Elon Musk. On Tuesday, which backers proclaimed DogeDay, the cryptocurrency was valued at more than fifty billion dollars, which is more than the market cap of Ford. Coinbase, a cryptocurrency exchange, went public last Wednesday; almost immediately, it became worth more than G.M.

The mainstreaming of cryptocurrency, as it's been called, is obviously a big deal for the world of finance. It's also a big deal for the world of, well, the world. This is particularly true in the case of the ur-cryptocurrency, Bitcoin. Like Dogecoin, bitcoin has recently surged in value. In April, 2020, a coin was worth about seven thousand dollars; today, it's worth more than fifty-five thousand. (It hit a record high of $64,895.22 on April 14th, but has since fallen off.) As the cost of investing in bitcoin has soared, so, too, has the potential profit in "mining" it. Bitcoin mining is, of course, purely metaphorical, but the results can be every bit as destructive as with the real thing.

The mainstreaming of cryptocurrency, as it's been called, is obviously a big deal for the world of finance.

According to the Cambridge Bitcoin Electricity Consumption Index, bitcoin-mining operations worldwide now use energy at the rate of nearly a hundred and twenty terawatt-hours per year. This is about the annual domestic electricity consumption of the entire nation of Sweden. According to the Web site Digiconomist, a single bitcoin transaction uses the same amount of power that the average American household consumes in a month, and is responsible for roughly a million times more carbon emissions than a single Visa transaction. At a time when the world desperately needs to cut carbon emissions, does it make sense to be devoting a Sweden's worth of electricity to a virtual currency? The answer would seem, pretty clearly, to be no. And, yet, here we are.

The Greenidge Generating Station in Dresden, New York, sits on the shores of Seneca Lake, about an hour southeast of Rochester. It was originally built in the nineteen-thirties to run on coal; over the decades, new units were added and older ones shuttered. The power station ceased

operations in 2011, and it sat idle until it was purchased by a private-equity firm and converted to run on natural gas. In 2017, under the ownership of Greenidge Generation Holdings, the plant reportedly began operating as a "peaker plant," to provide power to the grid during times of high demand. (A spokesperson noted that the plant "is permitted to run 24/7.") Then, in 2019, it was announced that the plant would power bitcoin mining.

Mining is the process by which bitcoin is both created and accounted for. Instead of being cleared by, say, a bank, bitcoin transactions are recorded by a decentralized network—a blockchain. Miners compete to register the latest "block" of transactions by solving cryptographic puzzles. The first one to the solution is rewarded with freshly minted bitcoin. Miners today receive 6.25 bitcoins per block, which, at current values, are worth more than three hundred thousand dollars.

It's unclear exactly who dreamt up bitcoin, so no one knows what this person (or persons) was thinking when the mining protocols were first established. But, as Ari Juels, a computer scientist at Cornell Tech, recently explained to me, the arrangement seems to have been designed with equity in mind. Anyone devoting a processor to the enterprise would have just as much stake in the outcome as anyone else. As is so often the case, though, the ideal was soon subverted.

"What was quickly discovered is that specialized computing devices—so-called mining rigs—are much, much more effective at solving these puzzles," Juels said. "And, in addition, there are economies of scale in the operation of these mining groups. So the process of mining, which was originally conducted by a loose federation of presumably individual participants with ordinary computing devices, has now become heavily consolidated."

Because rig "farms," which are essentially like server farms, consume a lot of energy, bitcoin-mining operations tend to chase cheap electricity. Roughly seventy per cent of bitcoin mining today takes place in China. (A recent study found that the associated electricity consumption could "potentially undermine" China's efforts to curb its carbon emissions.) Russia is also a bitcoin-mining center—there are big operations in Siberia, where cold temperatures help keep rig farms from overheating—as is Iran, where electricity is subsidized.

In the United States, home to about seven per cent of the world's bitcoin mining, finding cheap power can be complicated. A few years ago, miners "descended upon" the city of Plattsburgh, New York, about a hundred

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

and fifty miles north of Albany, which gets much of its electricity from hydroelectric dams on the St. Lawrence River. The power is relatively inexpensive, but, once Plattsburgh uses up its allotment, it has to purchase more at higher rates. Bitcoin mining drove up the cost of electricity in the city so dramatically that, in 2018, Plattsburgh enacted a moratorium on new mining operations.

Buying a generating station, as Greenidge Generation Holdings has done, is a way around the problem. Let others pay retail; Greenidge now gets its power "behind the meter." The firm recently announced that it was going public, via a merger with a Nasdaq-listed company called Support.com, and boasted that it "expects to be the first publicly traded bitcoin mining company with a wholly-owned power plant." In the announcement, Greenidge said that it was planning to more than double its bitcoin-mining operations in Dresden by the fall of 2021, and to double them again by the end of 2022. It further declared that it intends to "replicate its vertically integrated mining model at other power sites."

To expand its operations in Dresden, Greenidge will have to burn more and more natural gas, thus producing correspondingly more greenhouse-gas emissions. The firm's plans have sparked demonstrations in the Finger Lakes region. On Saturday, a hundred protesters marched to the gates of the plant.

"This is a test case," Joseph Campbell, the president of Seneca Lake Guardian, the group that organized the march, told WRFI, an Ithaca radio station. Two days later, the local planning board approved Greenidge's application to build four new structures at the site, to house more mining rigs. Members of the planning board said that for, legal reasons, they were barred from considering the broader implications of their decision. "We know that bitcoin is a big waste of energy," the chairman of the planning board, David Granzin, said. "But we're bound by law."

Whether this is, in fact, the case is debatable. What's beyond debate—or should be, at least—is that this is a matter that shouldn't be left to a local planning board to decide. There's no way for New York, or the U.S. as a whole, to meet its emissions-reductions goals if old generating stations, rather than being closed, are converted into bitcoin-mining operations. Greenidge may become the first mining firm with a "wholly-owned power plant," but, unless the state or federal government steps in, it won't be the last: another cryptocurrency firm, Digihost International, has already applied to New York State's Public Service Commission for permission to purchase a natural-gas-burning station near Buffalo. As representatives of

Earthjustice and the Sierra Club recently put it, in a letter to officials of New York's Department of Environmental Conservation, "additional scrutiny . . . is essential to prevent the floodgates opening for other retiring power plants."

Andrew Yang, the former Presidential candidate who's now running for mayor of New York City, has said that he wants to turn the city into a cryptocurrency-mining hub. It's hard to imagine a worse idea. The city is already looking at spending billions of dollars to protect itself from sea-level rise; increased emissions are pretty much the last thing it needs. Forward-looking politicians should be thinking about ways not to buoy bitcoin mining but to bury it.

newyorker.com, 22 April 2021

https://www.newyorker.com

Videocalling needed more than a pandemic to finally take off. Will it last?

2021-04-20

Eileen Donovan, an 89-year-old mother of seven living in a Boston suburb, loved watching her daughter teach class on Zoom during the coronavirus pandemic. She never imagined Zoom would be how her family eventually attended her funeral.

Donovan died of Parkinson's disease on June 30, 2020, leaving behind her children, 10 grandchildren and six great-grandchildren. She always wanted a raucous Irish wake. But only five of her children plus some local family could be there in person, and no extended family or friends, due to coronavirus concerns. This was not the way they had expected to mourn.

For online attendees, the ceremony didn't end with hugs or handshakes. It ended with a click on a red "leave meeting" button, appropriately named for business meetings, but not much else.

It's the same button that Eileen Donovan-Kranz, Donovan's daughter, clicks when she finishes an English lecture for her class of undergraduate students at Boston College. And it's the same way she and I ended our conversation on an unseasonably warm November day: Donovan-Kranz sitting in front of a window in her dining room in Ayer, Mass., and me in my bedroom in Manhattan.

"I'm not going to hold the phone during my mother's burial," she remembers thinking. Just a little over a year ago, it would have seemed

The COVID-19 pandemic has profoundly changed the way people interact with each other and with technology.

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

absurd to have to ask someone to hold up a smartphone so that others could "attend" such a personal event. Donovan-Kranz asked her daughter's fiancé to do it.

The COVID-19 pandemic has profoundly changed the way people interact with each other and with technology. Screens were for reminiscing over cherished memories, like watching VHS tapes or, more recently, YouTube videos of weddings and birthdays that have already happened. But now, we're not just watching memories. We're creating them on screens in real time.

As social distancing measures forced everyone to stay indoors and interact online, multibillion-dollar industries have had to rapidly adjust to create experiences in a 2-D world. And although this concept of living our lives online — from mundane work calls to memorable weddings or concerts — seems novel, both scientists and science fiction writers have seen this reality coming for decades.

In David Foster Wallace's 1996 novel Infinite Jest, videotelephony enjoys a brief but frenzied popularity in a future America. Entire industries emerge to address people's self-consciousness on camera. But eventually, the industry collapses when people realize they prefer the familiar voice-only telephone.

Despite multiple efforts by inventors and entrepreneurs to convince us that videoconferencing had arrived, that reality didn't play out. Time after time, people rejected it for the humble telephone or for other innovations like texting. But in 2020, live video meetings finally found their moment.

It took more than just a pandemic to get us here, some researchers say. Technological advances over the decades together with the ubiquity of the technology got everyone on board. But it wasn't easy.

Initial attempts

On June 30, 1970 — exactly half a century before Donovan's death — AT&T launched what it called the nation's first commercial videoconferencing service in Pittsburgh with a call from Peter Flaherty, the city's mayor, to John Harper, chairman and CEO of Alcoa Corporation, one of the world's largest producers of aluminum. Alcoa had already been using the Alcoa Picturephone Remote Information System for retrieving information from a database using buttons on a telephone. The data would be presented on the videophone display. This was before desktop computers were ubiquitous.

This was not AT&T's first videophone, however. In 1927, U.S. Secretary of Commerce Herbert Hoover had demonstrated a prototype developed by the company. But by 1972, AT&T had a mere 32 units in service in Pittsburgh. The only other city offering commercial service, Chicago, hit its peak sales in 1973, with 453 units. AT&T discontinued the service in the late 1970s, concluding that the videophone was "a concept looking for a market."

About a decade after AT&T's first attempt at commercialization, a band called the Buggles released the single "Video Killed the Radio Star," the first music video to air on MTV. The song reminded people of the technological change that occurred in the 1950s and '60s, when U.S. households transitioned away from radio as televisions became more accessible to the masses.

The way television achieved market dominance kept videophone developers bullish about their technology's future. In 1993, optimistic AT&T researchers predicted "the 1990s will be the video communication decade." Video would change from something we passively consumed to something we interacted with in real time. That was the hope.

When AT&T launched its VideoPhone 2500 in 1992, prices started at a hefty $1,500 (about $2,800 in today's dollars) — later dropping to $1,000. The phone had compressed color and a slow frame rate of 10 frames per second (Zoom calls today are 30 frames per second), so images were choppy.

Though the company tried to enchant potential customers with visions of the future, people weren't buying it. Fewer than 20,000 units sold in the five months after the launch. Rejection again.

Building capacity

Last June, to commemorate the 50th anniversary of AT&T's first videophone launch, William Peduto, Pittsburgh's mayor, and Michael G. Morris, Alcoa's chairman at the time, spoke over videophone, just as their predecessors had done.

Several scholars, including Andrew Meade McGee, a historian of technology and society at Carnegie Mellon University in Pittsburgh, joined for an online panel to discuss the rocky history of the videophone and its 2020 success. McGee told me a few months later that two things are crucial for a product's actual adoption: "capacity and circumstance."

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

Capacity is all about the technology that makes a product easy to use and affordable. For videophones, it's taken a while to get there.

When the Picturephone, which was launched by AT&T and Bell Telephone Laboratories, premiered at the 1964 World's Fair in New York City, a three-minute call cost $16 to $27 (that's about $135 to $230 in 2021). It was available only in booths in New York City, Chicago and Washington, D.C. (SN: 8/1/64, p. 73). Using the product required planning, effort and money — for low reward. The connection required multiple phone lines and the picture appeared on a black-and-white screen about the size of today's iPhone screens.

These challenges made the Picturephone a tough sell. Marketing researchers Steve Schnaars and Cliff Wymbs of Baruch College at the City University of New York theorized why videophones hadn't taken off decades before in Technological Forecasting and Social Change in 2004. Along with capacity and circumstance, they argued, critical mass is key.

For a technology to become popular, the researchers wrote, everybody needs the money and motivation to adopt it. And potential users need to know that others also have the device — that's the critical mass. But when everyone uses this logic, no one ends up buying the new product. Social networking platforms and dating apps face the same hurdle when they launch, which is why the apps create incentive programs to hook those all-important initial users.

Internet access

Even in the early 2000s, when Skype made a splash with its Voice over Internet Protocol, or VoIP, enabling internet-based calls that left landlines free, people weren't as connected to the internet as they are today. In 2000, only 3 percent of U.S. adults had high-speed internet, and 34 percent had a dial-up connection, according to the Pew Research Center.

By 2019, the story had changed: Seventy-three percent of all U.S. adults had high-speed internet at home; with 63 percent coverage in rural areas. Globally, the number of internet users also increased, from about 397 million in 2000, to about 2 billion in 2010 and 3.9 billion in 2019.

Broad reach

Access to high-speed, broadband internet has risen among U.S. adults, across all age groups. The data shown are for at-home use, excluding internet access via smartphone.

But even after capacity was established, we weren't glued to our videophones as we are today, or as inventors predicted years ago. Although Skype claimed to have 300 million users in 2019, Skype was a service that people typically used on occasion, for international calls or as something that took advance planning.

One long-time barrier that the Baruch College researchers cite from an informal survey is the aversion to always being "on." Some people would have paid extra to not be on camera in their home, the same way people would pay extra to have their phone numbers left out of telephone books.

"Once people experienced [the 1970s] videophone, there was this realization that maybe you don't always want to be on a physical call with someone else," McGee says. Videocalling developers had predicted these challenges early on. In 1969, Julius Molnar, vice president at Bell Telephone Labs, wrote that people will be "much concerned with how they will appear on the screen of the called party."

A scene from the 1960s cartoon The Jetsons illustrates this concern: George Jetson answers a videophone call. When he tells his wife Jane that her friend Gloria is on the phone, Jane responds, "Gloria! Oh dear, I can't let her see me looking like this." Jane grabs her "morning mask" — for the perfect hair and face — before taking the call.

That aversion to face time is one of the factors that kept people away from videocalling.

It took the pandemic, a change in circumstance, to force our hand. "What's remarkable," McGee says, "is the way in which large sectors of U.S. society have all of a sudden been thrust into being able to use videocalls on a daily basis."

Circumstance shift

Starting in March 2020, mandatory stay-at-home orders around the world forced us to carry on an abridged form of our pre-pandemic lives, but from a distance. And one company beat the competition and rose to the top within a matter of months.

Soon after lockdown, Zoom became a verb. It was the go-to choice for all types of events. The perfect storm of capacity and circumstance led to the critical mass needed to create the Zoom boom.

Before Zoom, a handful of companies had been trying to fill the space that AT&T's videophone could not. Skype became the sixth most downloaded

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

mobile app of the decade from 2010 to 2019. FaceTime, WhatsApp, Instagram, Facebook Messenger and Google's videochatting applications were and still are among the most popular platforms for videocalls.

Then 2020 happened.

Zoom beat its well-established competitors to quickly become a household name globally. It gained critical mass over other platforms by being easy to use.

"The fact that it's been modeled around this virtual room that you come into and out of really simplifies the connection process," says Carman Neustaedter of the School of Communication, Art and Technology at Simon Fraser University in Burnaby, Canada, where his team has researched being present on videocalls for work, home and health.

Zoom reflects our actions in real life — where we all walk into a room and everyone is just there. Casual users don't need to have an account or connect ahead of time with those we want to talk to.

Beyond design, there were likely some market factors at play as well. Zoom connected early with universities, claiming by 2016 to be at 88 percent of "the top U.S. universities." And just as K–12 schools worldwide started closing last March, Zoom offered free unlimited meeting minutes.

In December 2019, Zoom statistics put its maximum number of daily meeting participants (both paid and free) at about 10 million. In March 2020, that number had risen to 200 million, and the following month it was up to 300 million. The way Zoom counts those users is a point of contention.

But these numbers still provide some insight: If the product wasn't easy and helpful, we wouldn't have kept using it. That's not to say that Zoom is the perfect platform, Neustaedter says. It has some obvious shortcomings.

"It's almost too rigid," he says.

It doesn't allow for natural conversation; participants have to take turns talking, toggling the mute button to let others take a turn. Even with the ability to send private and direct messages to anyone in the room, the natural way we form groups and make small talk in real life is lost with Zoom.

It's also not the best for parties — it's awkward to attend a birthday party online when only one out of 30 friends can talk at a time. That's why some

people have been enticed to switch to other videocalling platforms to host larger online events, like graduations.

For example, Remo, founded in 2018, uses visual virtual rooms. Everyone gets an avatar and can choose a table after seeing who else is there, to talk in smaller groups. Instead of Zoom breakout sessions where you're assigned a room and can't enter another one on your own, a platform like Remo allows you to virtually see all the rooms and pick one, exit it and go to another one all without the help of a host.

The rigidity also results in Zoom fatigue, that feeling of burnout associated with overusing virtual platforms to communicate. Videocalling doesn't allow us to use direct eye contact or easily pick up nonverbal cues from body language — things we do during in-person conversations.

The psychological rewards of videocalling — the chance to be social — don't always outweigh the costs.

Jeremy Bailenson, director of the Virtual Human Interaction Lab at Stanford University, laid out four features that lead to Zoom fatigue in the Feb. 23 Technology, Mind and Behavior. Along with cognitive load and reduced mobility, he blames the long stretches of closeup eye gazing and the "all-day mirror." When you constantly see yourself on camera interacting with others, self-consciousness and exhaustion set in.

Bailenson has since changed his relationship with Zoom: He now hides the box that lets him view himself, and he shrinks the size of the Zoom screen to make gazing faces less imposing. Bailenson expects minor changes to the platform will help reduce the psychological heaviness we feel.

Other challenges with Zoom have revolved around security. In April 2020, the term "Zoombombing" arose as teleconferencing calls on the platform were hijacked by uninvited people. Companies that could afford to switch quickly moved away from Zoom and paid for services elsewhere. For everyone else who stayed on the platform, Zoom added close to 100 new privacy, safety and security features by July 2020. These changes included the addition of end-to-end encryption for all users and meeting passcodes.

Anybody's guess

In Metropolis, the 1927 sci-fi silent film, a master of an industrial city in the dystopian future uses four separate dials on a videophone to put a call through. Thankfully, placing a videocall is much easier than

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

it was predicted to be. But how much will we use this far-from-perfect technology once the pandemic is over?

In the book Productivity and the Pandemic, released in January, behavioral economist Stuart Mills discusses why consumers might keep using videocalling. This pandemic may establish habits and preferences that will not disappear once the crisis is over, Mills, of the London School of Economics, and coauthors write. When people are forced to experiment with new behaviors, as we did with the videophone during this pandemic, the result can be permanent behavioral changes. Collaboration through videocalling may remain popular even after shutdowns lift now that we know how it works.

Events that require real-life interactions, such as funerals and some conferences, may not change much from what we were used to pre-pandemic.

For other industries, videocalling may change certain processes. For example, Reverend Annie Lawrence of New York City predicts permanent changes for parts of the wedding industry. People like the ease of getting a marriage license online, and she's been surprisingly in demand doing video weddings since the pandemic started. Before, getting booked for officiating a wedding would require notice months in advance. "Now, I've been getting calls on Friday to ask if I can officiate a wedding on Saturday," she says.

Other sectors of society may realize that videocalling isn't for them, and will leave just a few processes to be done online. Jamie Dimon, CEO of JPMorgan Chase, for example, stated in a March 1 interview with Bloomberg Markets and Finance that he thinks a large portion of his staff will permanently work in the office when that becomes possible again. Culture is hard to build on Zoom, relationships are hard to strengthen and spontaneous collaboration is difficult, he said. And there's research that backs this.

But none of these changes or reversions to our previous normal are a sure bet. We may find, just like in Wallace's satirical storyline, that videocalls are just too much stress, and the world will revert back to phone calls and face-to-face time. We may realize that even when the technology gets better, the lifting of shutdowns and return to in-person life may mean fewer people are available for videocalls.

It's hard to say which scenario is the most likely to play out in the long run. We've been terribly wrong about these things before.

sciencenews.org, 20 April 2021

https://www.sciencenews.org

Anglerfish are stranger than science fiction

2021-04-26

In 1833, an almost perfectly spherical fish washed ashore in Greenland and was taken to zoologist Johannes Christopher Hagemann Reinhardt in Copenhagen, Denmark. This fish — later known as the footballfish, Himantolophus groenlandicus, or the man-gobbler — was the first anglerfish known to science, wrote Ted Pietsch, a systematist and evolutionary biologist, in his book "Oceanic Anglerfishes" (University of California Press, 2009).

Today, there are about 170 known species in 12 families of deep-sea anglerfish, and a "huge diversity" within those families, Mackenzie Gerringer, a professor of biology at SUNY Geneseo in New York who specializes in deep-sea fish told Live Science. Common names for anglerfish hint at some of the wild forms they can take — snaggletooth sea devil, wolf trap and pugnacious dreamer (also known as the tyrannical toad), to name just a few. They sport a fantastic range of shapes and textures; some are squat and round (Melanocetus johnsonii), while others are flat and huge-snouted (Thaumatichthys binghami) or covered in whiskery filaments (Caulophryne jordani). But while these fish are found all over the world, they are fairly elusive, solitary creatures — par for the course for a fish that lives 1,000 to 16,400 feet (300 to 5,000 meters) below the surface. As a result, new species are still being discovered, each more strange than the last.

But no matter what it looks like, any deep-sea anglerfish is a small ocean-dwelling creature's worst nightmare.

Anglerfish are named for the glowing lure they use to attract the fish and crustaceans they eat. These fearsome hunters lurk quietly in the depths of the ocean. They're ambush predators, Gerringer said, floating and waiting in the dark until prey comes near. Then, they use their built-in fishing rod to lure in the unlucky animal, wiggling, hiding and revealing their lure to tempt potential prey until they are close enough to be sucked up.

This feeding strategy explains anglerfish's bodies: Because they don't actively hunt, they haven't evolved to be fast swimmers, which is why

But no matter what it looks like, any deep-sea anglerfish is a small ocean-dwelling creature's worst nightmare.

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

many are blobby, non-hydrodynamic shapes. National Geographic even called anglerfish "quite possibly the ugliest animal on the planet" (though the blobfish would like a word).

In the deep ocean, meals are few and far between. Pietsch wrote in Oceanic Anglerfishes that most anglerfish stomachs that have been examined are empty. So when an anglerfish does come across a meal, they make it last. Anglerfish mouths are often the biggest part of their bodies, and if a meal "can fit in the mouth, it can fit in the body," Gerringer said. Many anglerfish can stretch their stomachs to double their original size.

"They'll end up with a bubble belly," she told Live Science. "Sometimes they're caught and they have whole fish in their stomachs. If you touch the stomachs, it's quite squishy, for lack of a better term."

But don't worry too much about these deep-sea horrors: They're far too small to hurt a human, making their oversized teeth and misshapen bodies… kinda cute? While some anglerfish can grow up to three or four feet (0.9 to 1.2 m) long (like Ceratias holboelli), the average size of an adult is 6 inches (16 centimeters) long — a little smaller than a volleyball.

Anglerfish lures glow in the deep ocean, at least half a mile (0.8 kilometers) below the sunlit surface, thanks to luminescent bacteria that take root in the fish's lure. The lure, also called an "esca," has a pore on the end that is designed to host these bacteria, many of which can't live anywhere else, and many of which are unique to that species of anglerfish.

But where do the glowing bacteria come from? Anglerfish are born deep in the ocean as tiny, transparent larvae and float alone to the surface to feed and develop into their adult forms. They don't grow an esca until later in life, so they have nowhere to nurture their bacterial colonies from birth, Gerringer said. "It's a big research question right now," she added. Of the anglerfish esca bacteria that have been studied, none have been found living freely in seawater, Pietsch wrote in his book, meaning that it's unlikely the fish pick their glowing buddies up from their environment. Do they live on an anglerfish's skin until the esca develops? Do they, as one study in the journal eLife suggested in 2019, come from adult anglerfish spewing bacteria into the water, to be immediately picked up by younger fish? "There's a lot of open questions," Gerringer said.

The diverse anglerfish don't stop at a simple glowing lure, though. Some species, such as Phyllorhinichthys balushkini, have elaborate light guides protruding from their bodies, like biological fiber optic cables. Others, like Cryptopsaras couesii, have glowing spots on their backs called caruncles.

Some, like members of the Thaumatichthys genus, have lures on the roofs of their mouths.

Once an anglerfish has lured in its prey, the fish has every incentive to keep it. According to Karly Cohen, a PhD candidate studying the biomechanics of fish teeth at the University of Washington, most animals sport teeth that are firmly attached to their jaws — with anglerfish as a notable exception. Some of their fang-like teeth are "depressable," or able to fold in under pressure. "It could be that the teeth are working similar to a spike guard in a parking garage," Cohen told Live Science. "It's easy for prey to go in the mouth, but hard for them to get out."

To understand anglerfish teeth, Cohen uses a technique called histology. She embeds teeth into resin blocks, and then slices that block microscopically thin. That way, she and her colleagues can stain and identify specific tissues (enamel, pulp and ligaments, for example) to determine how those teeth developed.

But a newer technique allows Cohen to get an even better look at one anglerfish's jawful of fangs. Using a CT scan, Cohen virtually sliced the entire fish into sections that could then be reassembled digitally and viewed from any angle.

Unlike us, Cohen said, "fish put teeth everywhere," and often in places that are hard to spot while just looking at a specimen. With a 3D rendering of a tiny (but ferocious) fish like Melanocetus johnsonii, just 2 inches (5 cm) in length, Cohen and her colleagues can make better models of these elusive animals' bite.

Many species of deep-sea anglerfish have one of the weirdest reproduction strategies on the planet. Males are parasites — and we don't mean that metaphorically.

In many deep-sea anglerfish species, the males are often 10 times smaller than females, said Gerringer, and they have no function other than to reproduce. They use highly developed scent organs to track down females. When they find one, they bite into her: According to Cohen, some male anglerfish develop specialized hooked teeth in front of their mouth specifically for getting a grip. (Cohen is researching whether these teeth are true teeth or a kind of proto-tooth called odontodes.) Then, they release an enzyme that dissolves the skin of their mouth, fusing with the female's body. The males become completely dependent on the female for sustenance; their circulatory systems merge so that they're sharing the same blood, and essentially the males become a living pair of testicles.

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

"Since there's a low probability to run into each other in the ocean, you want to be able to stick together when you find a mate. And they take this to the extreme," Gerringer said.

Females don't stop collecting partners when they have one male fused to them: The record, Gerringer said, is 12 males to one female.

The fusing that takes place is similar to an organ transplantation, since the males essentially become a part of the female's body. Research published in the journal Science in 2020 found out how anglerfish manage this feat: They lack genes to produce most of the molecules that would attack foreign tissue — plus they have few or no T-cells and antibodies. This lack of an immune system would likely kill a human, study co-author Dr. Thomas Boehm said in a press release describing the study, but it's exactly what anglerfish need to carry out their weird sexual parasitism-based reproduction.

Not many creatures in the ocean eat anglerfish (although some have been found in the stomachs of other deep-sea predators, such as the Antarctic toothfish, Dissostichus mawsoni), and since anglerfish make their home in deep water, they are not really targeted or accidentally caught by humans. So you might think that the anglerfish population is perfectly safe.

However, that's not the case. "We think of deep ocean communities as being out of sight, out of mind, but they're closely connected to the rest of the ocean ecosystem," Gerringer said. A recent opinion article published in the journal Proceedings of the National Academy of Sciences argued that deep-sea mining in search of increasingly scarce rare earth minerals could become a threat to the ocean. The emerging technology, as reported by Nature, could shoot sediments and mining waste from the seafloor up into the water column where it could remain in the mid-ocean. That habitat is home not just to anglerfish but tens of thousands of other species, according to a report in Science Daily. That muck could clog up gills, starve filter-feeders and change the way light — and the allure of an anglerfish's esca — travels in the ocean.

Climate change is a threat too, Gerringer said, by increasing ocean stratification. This means that water isn't mixing from the surface down into the deep ocean as much as it used to, so less oxygen is making its way down to the depths. Ultimately, though, anglerfish are still so mysterious that for many, "we just don't know" how humans might affect them, Gerringer said — or even what their baselines are.

But technology is improving all the time. In 2014, the Monterey Bay Aquarium Research Institute captured the first ever video of a "black seadevil" anglerfish and then brought it to the surface for a closer look, expecting that the fish wouldn't live long at sea level. But in 2018, National Geographic reported how scientists' ability to safely bring live deepwater fish to the surface is evolving. Someday soon, thanks to developments like these and the continued exploration of the deep ocean, we may know more about these bizarre, mysterious creatures.

livescience.com, 26 April 2021

https://www.livescience.com

Rerouting the Mississippi River could build new land—and could save a retreating coast

2021-04-22

In a swamp at the edge of Louisiana's Barataria Bay, plastic-capped GPS antennas sprout like oversize mushrooms from four small wooden platforms. The gear, which helps scientists monitor changes in the surrounding marsh, is easy to miss in this expanse of water and swampland the size of Delaware. But it represents something even bigger: the beginnings of a grand ecosystem engineering experiment that has been 50 years in the making and could ultimately cost some $50 billion.

If all goes as planned, 2 years from now engineers will punch a massive hole in a nearby levee that holds back the Mississippi River. A 3.5-kilometer-long canal will carry sand and muck from the muddy river into the bay, helping rebuild vast wetlands eroded by sinking land and rising seas. Over 5 decades, researchers forecast that the project—formally known as the Mid-Barataria Sediment Diversion—could move enough sediment to bury the island of Manhattan under 3 meters of muck and create at least 54 square kilometers of new wetlands. The diversion, expected to cost $2 billion, is a critical part of a much larger effort aimed at preventing coastal Louisiana, and the human and wild communities it supports, from slipping beneath the sea.

"There's nothing like [it] anywhere in the world," says coastal geoscientist Torbjörn Törnqvist of Tulane University, one of a small army of researchers who have helped shape the project through years of fieldwork, computer models, and even the use of a giant replica of the Mississippi River in Massachusetts. "It's going to be completely new."

If all goes as planned, 2 years from now engineers will punch a massive hole in a nearby levee that holds back the Mississippi River

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

The project, which will be financed with money paid by oil giant BP after the 2010 Deepwater Horizon oil spill, last month reached a key regulatory milestone and could begin by 2023. But it is not universally loved. Fishers who make their living pulling oysters and shrimp from nearby waters fear the influx of freshwater could harm their livelihoods. Local officials are questioning the cost. And some scientists are skeptical it will achieve the desired results, given the complexity of trying to tinker with one of the world's largest and most dynamic rivers.

But others are thrilled that the experiment may finally get underway, saying it could help heal the Louisiana coast and shape similar restoration projects elsewhere. "There's no question that this is huge," says John Lopez, a coastal scientist who was an early architect of coastwide restoration proposals for Louisiana and now runs a private consulting firm that advises environmental groups about the issue. He hopes it will become "a model for other areas in the world."

THE PROBLEM the Barataria diversion aims to address has been 150 years in the making. For millennia, the Mississippi built coastal Louisiana, depositing dirt and sand as it flooded and flipped from one channel to another. This land building explains why the river's delta pokes into the Gulf of Mexico, a swampy snout teeming with wildlife, marshy grasslands, and watery bayous darkened by ancient cypress trees.

In the late 1800s, people started to build a network of levees along the river's southern reaches to reduce flooding and ease navigation. Today, the Mississippi is little more than a massive canal, straitjacketed by earthen walls and traversed by massive freighters moving cargo bound for places as far north as Wisconsin. As the river pours into the Gulf of Mexico, just a trickle of its waters still flow into surrounding bays such as Barataria to the west and Breton Sound to the east.

Cut off from their steady supply of sediment, these marshlands have been sinking for 100 years. By 2016, the state had lost an estimated 4800 square kilometers of coastland since the 1930s. Nearly one-quarter of that loss occurred in Barataria Bay, and nearly 500 square kilometers in nearby Breton Sound, according to the U.S. Geological Survey.

Decades ago, scientists first suggested trying to restore the marshland by re-engineering part of the Mississippi. In 1975, Sherwood "Woody" Gagliano, a geographer and private environmental consultant who pioneered research into Louisiana's coastal erosion, mapped an elaborate system of levees and canals that could funnel freshwater and sediment into Barataria Bay. "The mistakes that we have made in our coastal areas

in the past were largely through ignorance," wrote Gagliano, who died in 2020. "If we … [continue] to make the same errors, destroying the invaluable renewable resources, the action is inexcusable."

For decades, however, little happened. Then, in 2005, Hurricane Katrina slammed into southern Louisiana, killing more than 1800 people, causing $161 billion in damage, and devastating New Orleans, just north of Barataria Bay. The loss of wetlands that had once blunted storms was partly to blame, scientists agreed. And restoration plans previously confined to scientific conferences and bureaucratic meetings suddenly took center stage. In 2007, state lawmakers endorsed the first iteration of what has become known as the coastal master plan, a 50-year initiative to salvage the state's coastline from the forces eating away at it: sinking land, rising seas, and channels dug for the oil and gas industry.

The plan includes a variety of measures: rebuilding barrier islands with new sand, hauling dredged muck to replenish drowning marshes, strengthening levees and flood barriers, and raising buildings above projected flood levels. But the most novel and ambitious piece is an updated version of Gagliano's vision of harnessing the Mississippi's power to build new land. In its latest iteration, the plan calls for creating 11 diversions along the Louisiana coastline. The first and biggest would be the massive mid-Barataria diversion, which would puncture the river's western bank.

From the beginning, money posed a major barrier. Completing all the projects would cost at least $50 billion, the state estimates, with the 11 diversions alone costing $5 billion.

Then BP's Deepwater Horizon drilling platform in the Gulf of Mexico exploded, unleashing the world's largest oil spill. The resulting fines promise to pour more than $7 billion into Louisiana's coffers, with much of the money earmarked for environmental restoration. At last, planners not only had a vision, but also the money to start to realize it. Last month, the plans for the mid-Barataria diversion passed a key landmark with the release of the preliminary draft of a massive, 7780-page environmental impact study by the U.S. Army Corps of Engineers (USACE). Although the study found the project could have some negative impacts on fisheries and wildlife, diversion proponents welcomed the finding that it would build significant new marshlands. That could prove critical for winning federal permits.

IN THE MID-1980S, wildlife biologist Andy Nyman witnessed one of the first small experiments to examine whether punching a hole in a

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

Mississippi levee could help rebuild bay wetlands. The state Department of Wildlife and Fisheries excavated gaps in land separating the river from several bays near where the river flows into the Gulf. At first, he recalls, he was unimpressed. After 3 months, there was little evidence of success. "I was like, 'Man, this thing hasn't done anything.' I thought it was a tremendous waste of time."

Twenty years later, however, Nyman, who is now at Louisiana State University (LSU), Baton Rouge, took a boat out to the area near the river's mouth. He discovered more than 100 hectares of reeds, cattails, and seagrasses now blanketed what had been open water. "It was so cool."

Many scientists predict the mid-Barataria diversion will conjure such scenes on a much bigger scale. But other experiments have shown forecasts are tricky. Just downstream of Barataria Bay, near the river's mouth, an effort called the West Bay project has helped create a string of sandy islands covering some 160 hectares. But when work began there in 2003, researchers expected nearly 10 times more land to form by now.

What happened? One problem was that water poured through the diversion so quickly that it flushed much of the new sediment into deeper water, says Alex Kolker, a coastal geologist at the Louisiana Universities Marine Consortium who has studied West Bay. On top of that, the land beneath the bay was sinking unusually fast because of the underlying geology, making it hard for the new sediment to compensate. Land did start to emerge after USACE built artificial islands in the bay with dredged sand. The islands then acted like speed bumps, slowing the diverted water and allowing more sediment to accumulate.

Such complexities make it hard to predict exactly how much land the new Barataria diversion will create. Last year, officials at Louisiana's Coastal Protection and Restoration Authority released a figure of up to 121 square kilometers of land over 50 years, based on hydrologic models developed by scientists in the Netherlands, a country renowned for its water management. In its recent environmental study, however, USACE cut that number by more than half, to just 54 square kilometers. The reduction reflected higher projections for sea level rise.

Even the latest estimate could be overly optimistic, data from the antenna-sprouting platforms have suggested. In 2016, a team led by Törnqvist drilled three core samples, each as wide as a saucer, from the muck beneath the platforms. The deepest plunged almost 40 meters, through 10,000 years of sediments. Scientists then mounted the GPS units on poles

cemented into the holes at different depths, to measure whether the marsh is sinking and by how much.

Analyses of sediment cores extracted from the deepest hole suggest buried layers, particularly peat, will compress when weight is added. As a result, new sediment might cause the marsh to sink, erasing much of the gains. Studies of the core samples suggest the land gain over 50 years could be as little as 1 centimeter, or as much as 1.75 meters, says Molly Keogh, a wetland geologist who led the research while earning a Ph.D. at Tulane. The range is large in part because of uncertainty about how much sediment the river will deliver. (Keogh's estimates don't include sea level rise, which could further erode the gains.)

Biology adds an uncertainty of its own. Eugene Turner, a coastal ecologist at LSU, notes that the Mississippi is often loaded with nutrients washed from farm fields farther upstream. As the new canal dumps those nutrients into the bay, he fears they could cause marsh plants to grow too fast to develop root systems hefty enough to hold sediment in place, leading to marsh erosion. "My concern is [the additional nutrients] will overwhelm the benefits," he says.

Tracy Quirk, a wetland plant ecologist at LSU, has been testing that idea. She has been adding different amounts of nutrients and sediments to more than 130 wetland plots in Barataria Bay, each 1 square meter in size. Two years of observations suggest even low levels of added nutrients catalyze root growth, she says. But, so far, she isn't seeing signs that those roots are weaker.

Far from Louisiana, engineers are running experiments aimed at reducing other uncertainties. In a warehouselike building in Massachusetts, they have built a model of the Mississippi and the planned Barataria diversion canal at 1/65th scale. It even includes canoe-size models of the giant freighters that ply the waterway. "Numeric models are good, but they don't get everything perfect," says Dan Gessler, a civil engineer and vice president at the Alden Research Laboratory, the firm that built the model in Holden, Massachusetts.

Using grains of plastic to simulate sand and silt, the researchers have studied how the water will move sediment from the river to the bay. One goal is to fine-tune the design of the canal to cope with the region's relatively flat topography, which could cause the water to slow and drop sediment too soon, clogging the waterway. They also want to be sure the diversion doesn't cause sand bars to form in the main river, disrupting its flow and blocking ships. "When you're spending over a billion dollars,"

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

Gessler says, "you want to be really confident that it's going to work exactly the way [you] expect it to."

But only the full-scale experiment will really dispel the questions, Törnqvist says. "The real interesting thing is going to be when the diversion actually gets going," he says. "We just can't wait."

THE UNCERTAINTIES OF POLITICS, however, could get in the way. The overall coastal plan enjoys bipartisan support from state and federal lawmakers. Major environmental groups, including the Environmental Defense Fund and the National Audubon Society, have endorsed the diversions. "This is a critical part of restoring the natural processes that built and sustained Louisiana," says Alisha Renfro, a sedimentologist with the National Wildlife Federation.

But some local governments and fishing interests warn that the mid-Barataria diversion threatens their way of life. This month, the governing council for Plaquemines parish, on the eastern edge of Barataria Bay, voted eight to zero to protest the project. "The whole … concept is going to devastate our fishing and seafood industry," says George Ricks, founder and president of the Save Louisiana Coalition, an alliance of local seafood interests. "There won't be nothing left once they do the diversion."

Scientists don't dispute that adding more freshwater to the bay's ecosystem will bring changes. Marsh plants that like brackish water, and some species of birds and fish, will likely benefit, Nyman says. "But there will be immediate costs" to species that thrive in saltier waters, he adds. For example, oysters and brown shrimp, mainstays of the local fishing industry, could be pushed out of their current ranges. The salinity drop could also cause skin diseases in the bay's 2000 dolphins, reducing their survival by as much as one-third, according to scientists at the National Oceanic and Atmospheric Administration.

Other critics question the diversion's cost, given the potential economic upheaval. "Holy mackerel! We're going to spend $2 billion for 12,000 acres?" says coastal oceanographer Joe Suhayda, who retired from LSU in 2002 and now consults for several local governments, including Plaquemines parish.

Many observers doubt those downsides will derail the diversion. But even if the project works as promised, they note a sobering reality: Even the most optimistic restoration scenarios see the state losing far more coastline than it will gain.

At the state's coastal restoration agency, officials often point to "the big red map." It forecasts what Louisiana's coastline will look like in 50 years, even if the state completes everything on its $50 billion to-do list. Small patches of green indicate wetlands it expects to save or restore, whereas a thick red fringe along the coast highlights marshes it expects to lose. All told, the state could protect or restore about 2000 square kilometers of wetland, the agency estimates, but other parts of the coast could lose more than 3700 square kilometers. In Barataria Bay alone, wetlands will shrink from 1500 square kilometers today to just 346 square kilometers by 2070 even with the diversion, according to USACE.

"We stopped promising a long time ago that we were ever going to be able to recreate a historical coastline," says Jim Pahl, a plant ecologist and senior scientist at the state coastal authority. Yet diversions can play an important role, he says. Although pumping in sediment with heavy equipment can rebuild patches of marshland, the land will continue to sink and disappear. Because the diversions keep delivering new sand and mud each year, Pahl says, they are critical for the state to "maintain anything resembling a sustainable system."

Törnqvist agrees, even though he concluded in a 2020 study published in Science Advances that efforts to save the Louisiana coast are probably doomed in the very long run if seas continue to rise. The mid-Barataria diversion and similar projects, he says, will be worth the cost if they buy time for vulnerable cities in the delta, including New Orleans, to adapt to climate change. "A few more decades can make the difference in the long run," he says, "between managed retreat and complete chaos."

sciencemag.org, 22 April 2021

https://www.sciencemag.org

People with rare blood cloths after a COIVD-19 jab share an uncommon immune response

2021-04-16

Evidence is building that an uncommon immune response is behind dangerous, but incredibly rare, blood clots associated with some COVID-19 vaccines. But the good news is that there is a test doctors can use to identify it and get patients the right care.

A small number of people out of the millions vaccinated with AstraZeneca's or Johnson & Johnson's COVID-19 shots have developed

A few have died.

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

severe blood clots, such as ones in the sinuses that drain blood from the brain (SN: 4/7/21; 4/13/21). A few have died.

Studies suggest that some inoculated people develop an immune response that attacks a protein called platelet factor 4 or PF4, which makes platelets form clots. Those platelets get used up before the body can make more. So these patients wind up with both the rare clots and low levels of blood platelets.

Of 23 patients who received AstraZeneca's jab and had symptoms of clots or low platelets, 21 tested positive for antibodies to PF4, researchers report April 16 in the New England Journal of Medicine. Of those, 20 people developed blood clots. The finding adds to previous studies that found the same antibodies in additional patients who got AstraZeneca's shot and had the dangerous clots.

Five out of six women who had clots after receiving Johnson & Johnson's shot in the United States also had PF4 antibodies, health officials said April 14 during an Advisory Committee on Immunization Practices meeting. That advisory group to the U.S. Centers for Disease Control and Prevention is assessing what needs to be done to lift a temporary pause on administering the Johnson & Johnson jab that was prompted by blood clot concerns (SN: 4/13/21). One man had developed brain sinus clots during the shot's clinical trial and a seventh case is under investigation, the pharmaceutical company said during the meeting.

"Because we are aware of this syndrome… we know how to treat it," says Jean Connors, a clinical hematologist at Harvard Medical School and Brigham and Women's Hospital in Boston who was not involved in the studies. And unlike the people who developed the clots before officials pinpointed the link, "we can diagnose it faster and treat it more appropriately if it does happen, so that the outcomes will be better."

That's because the vaccine-induced clots are similar to a condition called heparin-induced thrombocytopenia, or HIT. Patients with HIT develop blood clots when treated with the commonly used anti-coagulant drug heparin. Heparin attaches to the PF4 protein, and some people develop an immune response that attacks the two molecules.

Treating vaccinated patients who have PF4 antibodies with heparin is like "adding fuel to the fire" and may cause them to develop more clots, Connors says. Four of the six U.S. women who developed clots after getting the Johnson & Johnson vaccine, for instance, received heparin, as

did the man in the clinical trial. The man recovered and one woman was discharged from the hospital. Three were still hospitalized as of April 14.

Health care workers can test for antibodies that recognize PF4. And if a patient tests positive, there are many other anti-coagulants other than heparin that clinicians can use for treatment, Connors says.

sciencenews.org, 16 April 2021

https://www.sciencenews.org

Why American food wrappers are less toxic than Canadian

2021-04-19

Canadians are likely exposed to more toxic chemicals at the grocery store than Americans, according to a recent study.

The report, which was not peer-reviewed, found that receipts and food packaging used by several leading Canadian grocers and foodservice companies — including Tim Hortons, Sobeys, and Couche-Tard — could contain bisphenols, phthalates, PFAS, and other harmful chemicals.

Bisphenols are a class of endocrine disruptors commonly found lining receipts, while phthalates are hormone-disrupting chemicals used to make plastics more flexible, often found in plastic tubing and conveyor belts. PFAS — or per- and polyfluoroalkyl substances — are a class of carcinogens that harm the immune system and thyroid used to make food packaging grease-proof.

"Evidence tells us that chemicals like PFAS in food packaging and bisphenols on receipts are dangerous," said Tim Gray, executive director at Environmental Defence. The organization is a co-author on the report alongside U.S.-based environmental groups. "Market-leading Canadian retailers like Couche-Tard, Metro, Sobeys, and Tim Hortons have no excuse for their inaction to protect customers, workers, and the environment from toxics."

Often, eliminating these chemicals from supply chains, receipts, and items that touch food is largely a matter of company policy to research their presence in the supply chain and switch to safer alternatives. And the changes usually aren't prohibitively expensive, since most dangerous chemicals have safer and affordable alternatives, said Gray.

"Market-leading Canadian retailers like Couche-Tard, Metro, Sobeys, and Tim Hortons have no excuse for their inaction to protect customers, workers, and the environment from toxics."

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

The report compares and ranks the chemical policies and practices of 50 retail chains with stores in the United States and Canada. Canadian grocery chain Empire Co. — which owns Sobeys, Safeway, and other brands — and the Québec grocer Metro were at the bottom of the rankings. They were joined by Alimentation Couche-Tard (Circle K and Couche-Tard convenience stores), and Restaurant Brands International, parent company to Tim Hortons and Burger King.

"We were unaware of this report and therefore cannot comment. However, we have taken note and will be looking into it," said a spokesperson for Metro in response to the report. None of the other companies responded to a request for comment.

Topping the list were several U.S. companies, including grocery chains Whole Foods Market.

Dozens of other U.S. companies — and the Canadian grocery giant Loblaws Companies Ltd. — received middling or mediocre scores

While most companies have implemented some policies to protect customers from harmful chemicals primarily found in food packaging and receipts, Canadian grocers and retailers' efforts ranked consistently lower than those taken by their American counterparts.

It's a discrepancy maintained by Canada's environmental laws, explained Gray.

"Having a low regulatory bar encourages companies not to go much beyond it" when it comes to eliminating toxic chemicals, he said. "I think what that points out is that … government isn't keeping up with the science — we need regulatory reform."

That reform could be on the way.

The federal government last week tabled a bill to overhaul the Canadian Environmental Protection Act (CEPA). Under the proposed law, the agencies responsible for regulating toxic chemicals — Environment and Climate Change Canada and Health Canada — would be required to evaluate the cumulative impacts of exposure to multiple chemicals and their impact on vulnerable populations.

The agencies will need to conduct regular biomonitoring surveys. Biomonitoring is the measurement of chemical compounds or the products they make when they break down in people. Taken from blood,

urine, and other bodily tissues or fluids, the measurement indicates how much of a chemical is present in a person.

Large-scale biomonitoring studies that target a region or specific population provide insight into their level of exposure to toxic chemicals. Under the new law, the agencies will be required to conduct more large-scale surveys and use them to develop regulations that better protect vulnerable populations, according to Health Canada.

"Evaluation is key so that … chemicals are evaluated based on their impact on the target population, rather than the population as a whole," Gray said, noting that some chemicals have disproportionately large impacts on groups like children or pregnant women or are in products — like skin whiteners, for example — targeted to people based on race, employment, or other factors.

"No one experiences chemicals as a whole. Everyone experiences them individually, so it's a huge improvement to start thinking about the impact on identifiable populations who are going to have a disproportionate exposure or reaction to those chemicals," he said.

In a statement, Environment Canada said the new law would allow the federal government to conduct research about the cumulative impact of chemicals and their impact on vulnerable populations. The government would also be required to consider its findings while developing regulations for chemicals.

Canada is a laggard when it comes to accounting for the disproportionate impact some chemicals have on vulnerable populations, Gray said.

U.S. federal laws have required the country's federal government to account for vulnerable populations in its laws regulating toxic chemicals since at least 2016. Washington, Maine, and other states have also implemented similar regulations.

Despite the federal government proposal, the new laws remain far from coming into force — and they are badly needed.

"We really should … be able to count on government for regulating a bottom line so (Canadians) aren't exposed. It's important for companies to show leadership, but government really needs to raise the bar," Gray said.

nationalobserver.com, 19 April 2021

https://www.nationalobserver.com

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

Why copper and lithium could be 'the new oil'

2021-04-20

London (CNN Business)For decades, crude oil has been at the center of global commodities markets. Demand has served as a crucial metric of economic health, and price spikes have had major ramifications for gas-guzzling consumers.

But as countries around the world try to combat the climate crisis, oil could take a backseat, while metals like copper and lithium gain prominence.

"The critical role copper will play in achieving the Paris climate goals cannot be overstated," Goldman Sachs analysts said in a recent research note titled "Copper is the new oil."

Setting the scene: Copper is an essential component of systems that allow wind, solar and geothermal energy to be tapped and transmitted for applications like heating homes, the analysts noted.

And the market already looks tight. Copper prices have rallied 80% over the past 12 months, and supply is constrained as demand skyrockets. It takes two to three years to extend an existing mine, and as many as eight years to establish a new project, according to Goldman Sachs.

Copper prices have rallied 80% over the past 12 months, and supply is constrained as demand skyrockets.

That could set up the price of copper to jump from current prices of more than $9,000 per tonne to $15,000 per tonne by 2025, per the bank's estimates.

There's also a growing focus on lithium, a key component for batteries in electric cars. In a recent note, analysts at Macquarie Research predicted that demand for electric vehicles could trigger "material shortages" of the metal from 2025.

These constraints are putting lithium miners in the spotlight. On Monday, Australia's Orocobre and Galaxy announced a $3.1 billion merger that would create one of the biggest lithium companies in the world.

Why it matters: Global carbon dioxide emissions are set to surge dangerously this year as the global economy undergoes a huge recovery, according to a report published Tuesday by the International Energy Agency.

The Paris-based group estimates that carbon emissions from energy use are on track to spike by 1.5 billion tonnes in 2021, as heavy coal consumption in Asia, and in China in particular, outweighs rapid growth

in renewable sources. That would be the second largest annual increase in energy-related emissions in history.

"This is a dire warning that the economic recovery from the Covid crisis is currently anything but sustainable for our climate," Executive Director Fatih Birol said in a statement.

Watch this space: The IEA is sounding the alarm before 40 world leaders come together later this week for a two-day virtual summit on the climate crisis convened by President Joe Biden. Birol called it a "critical moment to commit to clear and immediate action."

What to expect at Apple's spring event

Is Apple (AAPL) about to drop a ton of new products?

The company is hosting its first event of 2021 on Tuesday, and expectations are high, my CNN Business colleague Samantha Murphy Kelly reports.

Reading the signs: The invitations for the virtual press conference sent to reporters last week included an image of colorful spirals that form the Apple logo — a picture potentially made to look as if it had been produced by an Apple Pencil. That may be a clue hinting at updates to its iPad line.

Apple is expected to show off an updated iPad Pro with a faster processor, 5G support, a Thunderbolt port so it can connect to more external monitors and a Mini LED display.

Eleftheria Kouri, an analyst at tech market advisory firm ABI Research, said tablet shipments significantly increased in 2020, thanks in part to remote learning and working. But that uptick won't last forever.

"Tablet vendors, including Apple, need to introduce a really game-changing technological feature in order to boost sales and encourage consumers to replace their old devices," she said. "5G connectivity is one of these key features."

Perhaps the buzziest product in the rumor mill is the potential debut of AirTags, a Bluetooth locator that could helps you find items such as keys, wallets, laptops or even your car. AirTags have been reportedly in the works as far back as 2019.

The company could also walk users through an expected iOS 14.5 software update focused on privacy. Its upcoming App Tracking Transparency

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

feature will require app developers to explicitly divulge how they're collecting user data and what it'll be used for, and require user consent before they download or update apps from the App Store.

How to watch: Apple's event kicks off at 1:00 p.m. ET on its website, YouTube and Apple TV. With the company's shares up just 1.6% this year, expect Wall Street to be paying attention, too.

Facebook is joining the (very) crowded audio space

Facebook (FB) has long dominated much of our screen time. Now it's coming for our listening breaks, my CNN Business colleague Kerry Flynn reports.

The social media company just announced several new tools for creating and sharing audio, including "Live Audio Rooms" which will be tested in Facebook Groups before a broader rollout this summer. People will also soon be able to listen to and discover new podcasts directly on the Facebook app.

Facebook aims to "treat audio as a first-class medium in the way that we treat photos and videos," CEO Mark Zuckerberg said Monday in an interview with journalist Casey Newton.

The copycat effect: Facebook moved into video behind YouTube, disappearing photos after Snapchat (SNAP) and short-form content on the heels of TikTok. Now, it's again following the growth of a new medium and competitor. Audio has seen a resurgence with the rise of podcasts, and more recently, the app Clubhouse.

Zuckerberg said he likes audio since theoretically people can more easily consume it while multitasking, and also because the production is "more accessible." (It could also be a bet on keeping engagement up as we transition to a post-pandemic world.)

Will investors agree? So far, the reaction has been muted. Facebook's shares are up nearly 11% this year, but may struggle to break out before it posts earnings next week.

edition.cnn.com, 20 April 2021

https://www.edition.cnn.com

Here's how scientists are designing vaccines that can ditch the fridge

2021-04-21

From the cutting-edge vaccines for COVID-19 to the decades-old ones for poliovirus, most vaccines need to be kept cold to survive the trip from factory to patient. But that poses a major hurdle to even routine immunizations in countries like Mali or Bangladesh, where up to 90% of health facilities lack adequate refrigeration. To solve this problem, some researchers are working toward a radical goal: vaccine formulations that don't have to be kept cold. Significant hurdles remain, but many scientists are optimistic that 10 years from now vaccination campaigns won't be quite so hampered by the heat.

"I think we are at the limit of how many people we can vaccinate using [refrigerated supply chains]," says Asel Sartbaeva, a chemist at the University of Bath who is working on a molecular "cage" to make multiple vaccines temperature stable. "And this is where we come in."

Most vaccines include biomolecules or weakened forms of pathogens that start to fall apart above—or below—certain temperatures. Even when the formulas are freeze-dried or suspended in solutions to improve stability, many still require refrigeration between 2°C to 8°C, the temperature of a regular fridge. When vaccines don't have to be kept cold, the results can change the world: A freeze-dried smallpox vaccine that was stable for months at high temperatures was essential for eradicating the global scourge in the 1970s. Even incremental improvements can make a big difference: MenAfriVac, a meningitis vaccine that can now be kept without refrigeration for 4 days, cut costs in half during a 2011 vaccination campaign in Chad.

Scientists have different strategies for creating vaccines that can beat the heat, ranging from modified chemical solutions to new methods of delivery. Which strategy works best depends largely on the vaccine's active ingredient: RNA, DNA, live or inactivated virus or bacteria, or bits of the pathogen like peptides or proteins.

Protein-based vaccines, which are relatively stable, are "low-hanging fruits," says Maria Bottazzi, a microbiologist who co-directs the Texas Children's Hospital Center for Vaccine Development. But other types, like live attenuated viral vaccines, are especially susceptible to changes in temperature. Diverse approaches are necessary, she says: "There's no silver bullet."

Even when the formulas are freeze-dried or suspended in solutions to improve stability, many still require refrigeration between 2°C to 8°C, the temperature of a regular fridge

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

But there are silica cages. That's what Sartbaeva used to stabilize proteins in the common vaccine for diphtheria, tetanus, and pertussis (DTP). Because the DTP vaccine is made of proteins from each of the disease-causing microbes, it needs to be kept at 2°C to 8°C. Sartbaeva, whose previous research focused on the structure of porous silicate materials, thought silica might be able to create a protective molecular cage around the vaccine's proteins, preventing them from unfolding in the heat.

Over the next few years, Sartbaeva and colleagues developed a process in which reactive silica molecules are mixed with the proteins. Attracted to the biomolecules' positively charged regions, the silica comes together in a network that precisely matches the proteins' contours. "The cool thing about silica is that it's quite malleable," allowing for a perfect fit, Sartbaeva says.

Her group's silica cages stabilized diphtheria and tetanus proteins for at least 1 month at room temperature and 2 hours at 80°C, she and her colleagues reported last year in Nature Scientific Reports. When injected into mice, the caged proteins provoked an immune response; the uncaged proteins were duds. But several challenges remain before clinical trials are in sight: proving the method can stabilize all the proteins in the DTP vaccine at once and simplifying the process needed to dissolve the silica before the vaccine is injected.

Another approach is the "Fruit Roll-Up" method. Maria Croyle, a pharmacist at the University of Texas, Austin, encased live adenovirus—a vector used in multiple vaccines, including Johnson & Johnson's COVID-19 vaccine—within a solid film of sugars and salts with a texture similar to the popular snack. The film can be dissolved under the tongue or inside the cheek to administer the vaccine, or even reconstituted and injected. The film kept an adenovirus-based vaccine for Ebola stable at room temperature for 36 months, Croyle and colleagues reported last year in Science Advances. When reconstituted from the film and inhaled, the 3-year-old viruses protected primates from a lethal dose of Ebola.

The researchers add that by altering the mix of sugars and salts in the film, the method could work for other vaccines and therapeutics, including influenza vaccines. Croyle, who is also chief scientific officer of the biomedical startup Jurata Thin Film, says her colleagues there want to start clinical trials for a vaccine using the film within 12 to 18 months, once they determine how to scale up manufacturing. Michigan Technological University chemical engineer Caryn Heldt calls the film a "very promising

technology" for multiple vaccine platforms. Bottazzi agrees, and says she's considering testing the formulation with some vaccine prototypes.

Meanwhile, refrigeration-dependent messenger RNA vaccines—like those developed by Moderna and the Pfizer/BioNTech collaboration for COVID-19—present their own challenges. Some scientists have turned to a tried-and-true approach used with other vaccines: freeze-drying. Once a vaccine is freeze-dried, says Drew Weissman, an immunologist at the University of Pennsylvania, "It's essentially stable forever. … The big challenge is the cost."

New manufacturing techniques could help, but freeze-drying is a slow and expensive process, and it doesn't work for every vaccine. Just this month, however, Pfizer started clinical trials on a freeze-dried version of its vaccine designed to be stable at regular refrigerator temperatures; currently, it has to be stored at about –20°C. Results are expected at the end of May.

Another strategy: Alter the lipid nanoparticles that surround the vaccines' RNA molecules; it is these nanoparticles that are responsible for the vaccines' ultracold storage requirements. Seattle-based HDT Bio recently took this tack, inventing a nanoparticle that can be shipped in regular refrigerators, then combined with RNA just before injection, says Amit Khandhar, the company's chief of formulations. The approach doesn't entirely eliminate the need for refrigeration, and the more stable formulation does not provoke as much of an immune response, Weissman says. But the world may soon know how well it performs in the wild: A vaccine candidate for COVID-19 using the company's nanoparticles is about to start clinical trials in India.

To avoid cold storage entirely, another option is to use DNA instead of RNA. DNA, the more stable of the two nucleic acids, "could be sitting in a warehouse at room temperature for months," says Deborah Fuller, a microbiologist at the University of Washington, Seattle, who helped design the HDT Bio vaccine. DNA vaccines have not had much clinical success despite years of research, Fuller says, though a number of DNA vaccines for COVID-19 are in clinical trials.

But even if technical hurdles are overcome, getting temperature-stable formulations to market requires "aligning all the stars," for manufacturers and regulators, Bottazzi says. Encouraging drug developers to spend millions of dollars on new formulations is no easy task. Incentives are rare, especially when it comes to reformulating existing vaccines, says Jason Hallett, a chemist at the Future Vaccine Manufacturing Research (FVMR) Hub at Imperial College London who works on temperature-stable vaccine

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

formulations using liquid salts. Under current regulations, "It is more cost effective to improve the cold chain than it is to eliminate the cold chain," he says.

Yet the enormous resources that countries have poured into COVID-19 vaccine research could change the outlook for temperature-stable formulations, says Benjamin Pierce, operations manager at the FVMR Hub. A temperature-stable vaccine may not come in time for the current pandemic, he says, but as the world prepares for the next one, "eliminating the cold chain will absolutely be a priority."

sciencemag.org, 21 April 2021

https://www.sciencemag.org

Tarantulas conquered Earth by spreading over a supercontinent, then riding its broken pieces across the ocean

2021-04-21

Tarantulas, everyone's favorite hairy spiders, are found worldwide, inhabiting all continents except Antarctica. But how did they become so widespread? Females rarely leave their burrows, spiderlings stick close to where they hatch, and mature males only travel when they're searching for a mate.

To answer this question, researchers went looking for the origins of the tarantula group more than 100 million years ago, building a tarantula family tree based on molecular clues from existing databases of spiders' transcriptomes — the protein-coding portion of the genome, found in ribonucleic acid, or RNA.

Once they created the tree, they mapped it to a timeline of spider fossils, to estimate when — and where — tarantulas appeared and dispersed.
PLAY SOUND

The scientists discovered that tarantulas first emerged during the Cretaceous period in what is now the Americas. But at the time, the Americas were part of the massive supercontinent Gondwana. Ancient tarantula relatives, even if they were homebodies like tarantulas today, likely spread across the joined landmasses, dispersing from the Americas into Africa, Australia and India. Then, after Gondwana broke apart, India separated from Madagascar and collided with Asia — and brought the hairy spiders to that continent, too, he researchers reported.

The scientists discovered that tarantulas first emerged during the Cretaceous period in what is now the Americas.

There are only two known tarantula fossils, both preserved in amber: One is from Mexico, and is thought to be around 16 million years old, and the other is from Myanmar and is about 100 million years old, the study authors reported. Because tarantula fossils are so rare, the researchers also collected data from related mygalomorphs — the arachnid group that includes tarantulas and other big, ground-dwelling spiders — that are better represented in the fossil record than are tarantulas.

After constructing a family tree for tarantulas from transcriptome data, representing 29 tarantula species and 18 other mygalomorphs, the scientists time-calibrated the tree using data from fossils. This enabled the researchers to calculate the ages of tarantula lineages, and to approximate when the ancestors of modern tarantulas spread over the world.

Tarantula timeline

According to this new timeline, tarantulas first appeared in the Americas about 120 million years ago. There, the spiders that were ancestors to Africa's tarantulas emerged around 112 million to 108 million years ago. By about 108 million years ago, tarantulas were established in what is now India. India separated from Madagascar between 95 million and 84 million years ago, and drifted toward Asia; that slow-motion collision, which began between 58 million and 35 million years ago, brought tarantulas to the Asian continent.

However, before that happened, India's tarantulas diverged into two lineages with different lifestyles: One group of tarantulas was predominantly tree-dwellers, and the other mostly preferred life in burrows. Both lineages eventually spread into Asia, but the arboreal group (Ornithoctoninae, also known as "Earth tigers") did so 20 million years after their burrowing cousins.

This second, later wave of tarantula dispersal into Asia suggests that the spiders were able to fill ecological niches and adapt to new habitats more effectively than once thought.

"Previously, we did not consider tarantulas to be good dispersers," lead study author Saoirse Foley, an evolutionary biologist at Carnegie Mellon University in Pittsburgh, said in a statement. "While continental drift certainly played its part in their history, the two Asian colonization events encourage us to reconsider this narrative," Foley said.

The findings were published online April 6 in the journal PeerJ.

CHEMWATCH
Bulletin Board
Curiosities
APR. 30, 2021

Originally published on Live Science.

livescience.com, 21 April 2021

https://www.livescience.com

X-ray scans explain how the 'Brazil nut effect' works

2021-04-22

A new experiment reveals, in a nutshell, why the largest particles in some mixtures tend to gather at the top.

This phenomenon is known as the Brazil nut effect, since jostling mixed nut packages tends to bring bulky Brazil nuts to the top. The effect can also be seen in cereal boxes and even space rocks (SN: 8/15/14). Understanding how it works could help manufacturers create more uniform mixtures of ingredients for food processing, or more even distributions of active ingredients in medicine tablets, researchers report April 19 in Scientific Reports.

The Brazil nut effect has been tough to crack because it's difficult to track how individual objects move around in the middle of a mixture, says Parmesh Gajjar, an imaging scientist at the University of Manchester in England. Using X-ray CT scans, Gajjar and colleagues followed the motion of individual peanuts and Brazil nuts in a box as it was shaken back and forth — creating the first 3-D videos of the Brazil nut effect in action.

In the videos, the Brazil nuts, which are oblong, mostly laid horizontally when they were first dumped into the container. But as the box shook, collisions between nuts nudged some of the Brazil nuts to point more vertically. That vertical orientation opened up space for the smaller peanuts higher in the mixture to tumble down and accumulate at the bottom, pushing the Brazil nuts upward.

While this finding could satisfy the curiosity of mixed nut aficionados, that's peanuts compared to the practical use it could have for the pharmaceutical industry.

sciencenews.org, 22 April 2021

https://www.sciencenews.org

This phenomenon is known as the Brazil nut effect, since jostling mixed nut packages tends to bring bulky Brazil nuts to the top.

CHEMWATCH

Bulletin Board

Technical Notes

APR. 30, 2021

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

CHEMICAL EFFECTS

The effect of reduction measures on concentrations of hazardous semivolatile organic compounds in indoor air and dust of Swedish preschools

ENVIRONMENTAL RESEARCH

Impact of a pollution breach at a coke oven factory on asthma control in nearby vulnerable adults

Impacts to Larval Fathead Minnows Vary between Preconsumer and Environmental Microplastics

Impact assessment of odor nuisance, health risk and variation originating from the landfill surface

OCCUPATIONAL

Interventional radiologists have a higher rate of chromosomal damage due to occupational radiation exposure: a dicentric chromosome assay

Genotoxic effect of exposure to polycyclic aromatic hydrocarbons (PAHs) in asphalt workers

Polycyclic aromatic hydrocarbons associated long non-coding RNAs and heart rate variability in coke oven workers

Lack of transgenerational effects of ionizing radiation exposure from the Chernobyl accident

PHARAMACEUTICAL/TOXICOLOGY

Epigenome-wide DNA methylation signature of benzo[a]pyrene exposure and their mediation roles in benzo[a]pyrene-associated lung cancer development

Life-course exposure to perfluoroalkyl substances in relation to markers of glucose homeostasis in early adulthood