CHEMWATCH

Bulletin Board

Contents

SEP. 30, 2022

(click on page numbers for links)

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*** 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

HAZARD ALERT

GOSSIP

CURIOSITIES

CHEMWATCH
Bulletin Board

Contents

SEP. 30, 2022

TECHNICAL NOTES

ASIA PACIFIC

Dust monitors to be mandatory on Delhi construction sites

2022-09-20

The regional government in Delhi has drafted regulations making it mandatory for all large construction sites in the city to install air quality monitoring equipment.

Airborne dust is one of the main sources of pollution in Delhi. A 2018 joint study by the Energy & Resources Institute and the Automotive Research Association of India found that construction contributed 25% of PM2.5 and 17% of PM10 pollution in the city during the winter season.

'PM2.5' refers to particulate matter in which the particles are less that 2.5 micrometres in diameter; PM10 particles are less that 10 micrometres in diameter.

In 2020 the Delhi government published guidance containing 14 measures that must be followed at construction sites to combat dust pollution.

The new regulations currently under consideration would require all construction sites measuring 20,000 square metres or more to install three air quality monitors to record dust emissions on a continuous basis.

Read More

The Construction Index, 20-09-22

https://www.theconstructionindex.co.uk/news/view/dust-monitors-to-be-made-mandatory-on-delhi-construction-sites

What does 'significant' or 'significantly' mean in a specific information requirement?

2022-09-19

An Inventory listing for a chemical may include a 'specific information requirement'. This means that we have assessed the chemical and you are obligated to tell us about your introduction in certain situations.

To help you meet these obligations, we've added more details to our page on 'what is a specific information requirement'.

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 30, 2022

The information includes:

- An example of a 'specific information requirement' you may see on an Inventory listing
- Examples of when we use the words 'significant' or 'significantly' to describe situations where you are proposing to use the chemical in an way that is different to what we originally assessed
- Various scenarios to help you understand how specific information requirements could work and how you could meet your obligations, if required
- What to do if you can't find our assessment report

Read More

AICIS, 19-09-22

https://www.industrialchemicals.gov.au/news-and-notices/what-does-significant-or-significantly-mean-specific-information-requirement

Available now: download the latest Inventory snapshot

2022-09-15

We took a snapshot of all the chemicals on the Inventory on 1 September 2022 and published it as a downloadable spreadsheet. We've made this available in an Excel format (.xlsx).

Please note that the spreadsheet is not current and is not the official complete Inventory. It also does not contain links to assessments or evaluations and excludes chemicals that cannot be disclosed to the public because the terms are confidentially listed.

The next version of the downloadable Inventory is expected to be available in 2023.

Read More

AICIS, 15-09-22

https://www.industrialchemicals.gov.au/news-and-notices/available-now-download-latest-inventory-snapshot

AMERICA

Study finds potentially dangerous levels of arsenic in California prison drinking water

2022-09-21

Berkeley — Ten years after the state of California recognized the human right to water, hundreds of thousands of residents still rely on drinking water that contains dangerous levels of contaminants, including the highly toxic mineral arsenic. Many of them live in low-income and rural communities that struggle to afford the necessary infrastructure to remove arsenic from drinking water.

A new study led by researchers at the University of California, Berkeley, and Virginia Tech is one of the first to analyze how incarcerated individuals in California may be impacted by arsenic-contaminated water.

The study, which will appear online Sept. 21 in the journal Environmental Health Perspectives, analyzed 20 years of water quality data from Kern Valley State Prison and the nearby Central Valley communities of Allensworth, McFarland and Delano, where many groundwater aquifers contain unhealthy levels of naturally-occurring arsenic. At all four locations, the study found instances when the arsenic levels in the water supply exceeded regulatory limits for months or even years at a time.

"There has been a lot of work, primarily by journalists and by incarcerated people themselves, that suggests serious environmental health hazards in prisons, and yet there have been very few studies looking at these environmental health challenges," said study first author Jenny Rempel, a graduate student in UC Berkeley's Energy and Resources Group. "This is one of the few studies to document ongoing structural challenges to realizing this basic human right to water on both sides of the prison walls."

Read More

EurekAlert, 21-09-22

https://www.eurekalert.org/news-releases/965114

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 30, 2022

EPA Proposes PFOA And PFOS Designation as Hazardous Substances

2022-09-19

On August 26, 2022, the EPA proposed to designate perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), including their salts and structural isomers, as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as "Superfund."

These substances are two of the most widely used per- and polyfluoroalkyl substances (PFAS), which are known as "forever chemicals" due to their inability to break down over time in the environment. Research shows that these chemicals accumulate in the human body. A report by the Centers for Disease Control and Prevention's National Health and Nutrition Examination Survey (NHANES) found PFAS in the blood of 97 percent of Americans. Evidence suggests that exposure to PFOA and/or PFOS may lead to cancer and reproductive, developmental, cardiovascular, liver, and immunological effects.

"Communities have suffered far too long from exposure to these forever chemicals. The action announced today will improve transparency and advance EPA's aggressive efforts to confront this pollution, as outlined in the Agency's PFAS Strategic Roadmap," EPA Administrator Michael S. Regan says in an EPA press release. "Under this proposed rule, EPA will both help protect communities from PFAS pollution and seek to hold polluters accountable for their actions."

If finalized as proposed, the rulemaking would require releases of PFOA and PFOS that meet or exceed the reportable quantity of 1 pound to be reported to the National Response Center, state or tribal emergency response commissions, and local or tribal emergency planning committees. The regulations will require reporting to occur within 24 hours from release.

"EPA is focused on holding responsible those who have manufactured and released significant amounts of PFOA and PFOS into the environment," continues the Agency press release. "EPA will use enforcement discretion and other approaches to ensure fairness for minor parties who may have been inadvertently impacted by the contamination. EPA is also committed to doing further outreach and engagement to hear from impacted communities, wastewater utilities, businesses, farmers and other parties during the consideration of the proposed rule."

Read More

EHS Daily Advisor, 19-09-22

https://ehsdailyadvisor.blr.com/2022/09/epa-proposes-pfoa-and-pfos-designation-as-hazardous-substances/

NYS lawmakers introduce legislation to crack down on 'forever chemicals' in water sources

2022-09-20

Bipartisan group Seneca Lake Guardian, along with nonprofit Earthjustice, Senator Rachel May, and outgoing Health Committee Chair Richard Gottfried, urged statewide action on pervasive PFAS chemicals Monday.

The toxic per- and polyfluoroalkyl substances, or PFAS, are known as 'forever chemicals' as they persist in the environment and are difficult to clean up.

PFAS are found in many everyday products including non-stick pans and popcorn bags.

Once these items make their way into landfills, leachate, or contaminated water containing PFAS makes its way into drinking water sources.

Seneca Meadows, New York's largest landfill, produces 75 million gallons of leachate every year which is hauled, untreated, to Buffalo, Watertown, Chittenango, Steuben County and even Newark, New Jersey. All these locations bear the cost of filtering leachate out of local drinking sources.

In response to Sen. May and Assemblymember Dr. Anna Kelles announced the PFAS Surface Water Discharge Disclosure Act, legislation that would require annual testing for all facilities permitted to discharge water.

Read More

WHAM, 20-09-22

https://13wham.com/news/local/nys-lawmakers-introduce-legislation-to-crack-down-on-forever-chemicals-in-water-sources

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 30, 2022

States Seek to Use PFAS-Contaminated Sewage Sludge to Fertilize Crops

2022-09-19

Some states in the U.S. are giving the go-ahead for the use of sewage sludge as a crop fertilizer with little to no testing, despite the sludge being contaminated with per- and polyfluoroalkyl substances (PFAS), also known as forever chemicals.

While only two states, Michigan and Maine, are currently testing for PFAS contamination in the sludge, other states are considering more widespread use and less testing for PFAS contamination in sewage sludge used for cropland. In Virginia, officials have allowed a larger amount of sewage sludge to be used in agriculture without requiring testing for PFAS. Officials in Alabama have also rejected a call to require testing for forever chemicals in the sludge.

"We're in an absolute mess, and the government knows we're in a mess, but it seems like they don't know what to do," said Julie Lay, an agricultural worker in Alabama. Lay has been working against the use of sludge, as reported by The Guardian.

Other states are still considering testing limits and the use of sewage sludge, which is the byproduct left from the water treatment process. The process doesn't remove PFAS, which can move from the sludge to soil and crops and further into the environment, contaminating local waterways, when used on cropland.

In Michigan and Maine, PFAS testing has revealed these forever chemicals existing in the sludge, soil, groundwater, livestock and blood of farmers. Maine has banned the use of sewage sludge as fertilizer.

An estimate from the Environmental Working Group (EWG) says PFAS could be contaminating more than 20 million acres of cropland in the U.S. Studies have linked PFAS exposure to various health risks, including decreased fertility, developmental effects in children, higher risk of certain types of cancer, suppressed immune systems, hormone interference and higher cholesterol levels.

Read More

EcoWatch, 19-09-2022

https://www.ecowatch.com/pfas-contamination-crop-fertilizer.html

Almost Half a Million New Yorkers Drinking PFAS-Polluted Water, Left Out of Current and Proposed NYS Protections

2022-09-19

Today, advocates urged Governor Hochul and the NYS Department of Health (DOH) to bring New York's drinking water standards on toxic PFAS in line with new EPA health advisories. They called for current standards on two PFAS chemicals, PFOA and PFOS, and proposed standards on 23 additional PFAS to be lowered to as close to zero as possible. This would ensure that New Yorkers would be directly notified about what's in their water, and that dangerous contamination would be eliminated.

New York's Maximum Contaminant Levels (MCLs) for PFOA and PFOS currently allow up to 10 parts per trillion (ppt) of each of these chemicals in drinking water. Those levels are 10 times higher than what EPA now says is safe.

Recently, the NYS Drinking Water Quality Council (DWQC) proposed new MCLs for 4 additional PFAS, also at 10 ppt each. In addition, the DWQC proposed Notification Levels (NLs) for 6 other PFAS at a combined 30 ppt and for 13 other PFAS at a combined 100 ppt. Advocates argue these proposals are too high to adequately protect public health given the similarities between those chemicals and PFOA and PFOS. MCLs require public notification and drinking water cleanup if exceeded; NLs only require public notification if exceeded.

According to a review of a selection of statewide testing data, at least hundreds of thousands of New Yorkers have PFOA, PFOS, and/or other PFAS in their water, but at levels below the current or proposed standards. The list of approximately 20 identified water utilities can be found on pages 3-5 of a letter recently sent to the Governor and DOH by a broad coalition of close to 40 organizations. These utilities have not been and likely would not be required to clean up their water, leaving New Yorkers at increased risk of developing serious illnesses like kidney and testicular cancer, thyroid disease, and more when they turn on the tap.

Read More

LongIsland.com, 19-09-22

https://www.longisland.com/news/09-19-22/almost-half-a-million-new-yorkers-drinking-pfas-polluted-water-left-out-of-current-and-proposed-nys-protections.html

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 30, 2022

EUROPE

EU Programs Conducting Survey on Risk Governance for Nanotechnology

2022-09-21

Gov4Nano, NANORIGO, and RiskGONE, three projects funded by the European Union (EU), are working together "to develop and establish a robust public policy framework for the use of nanomaterials based on scientific evidence supporting a clear understanding of risks, their assessment and management within wider societal considerations." The projects are conducting a survey to understand better how the needs of different stakeholders can be addressed through the outputs of the projects. According to the survey, these projects have produced:

- A blueprint for an organization to govern nanotechnology-related risk comprising individuals (experts, stakeholders) who provide "problem-solving capacity" to support decisions on new/emerging risks from engineered nanomaterials. The form of this organization could be:
- Option A: A permanent structure ("House") that develops and offers access to a risk governance framework and a range of data and tools (see below), as well as a series of activities and services, including advice, expert opinion, or technical assistance; or
- Option B: A "Taskforce" or committee, mobilized by the European Commission (EC) or others, to respond to specific needs or challenges, like the Scientific Committee on Health, Environmental and Emerging Risks (SCHEER).

Read More

Nano and Other Emerging Chemical Technologies Blog, 21-09-22

https://nanotech.lawbc.com/2022/09/eu-programs-conducting-survey-on-risk-governance-for-nanotechnology/

UK announces new BAT framework to tackle industrial emissions

2022-09-04

The United Kingdom recently launched the new 'Best Available Techniques' (BAT) framework to enable regulators and the industry to work together to identify and apply up-to-date and challenging standards to reduce harmful emissions and improve environmental performance. The

aim is to develop higher standards for industrial emissions, as the country moves away from the European Union's (EU) framework.

The BAT process includes agreeing and setting emissions limits within environmental permits and determining the types of technologies and methods operators should use to reduce their environmental impact.

Under the permits granted by environmental regulators to industrial facilities like textile and chemical industries, businesses must use the best techniques available to them to prevent or minimise emissions and their impacts on the environment.

The new framework will see the UK government and Devolved Administrations, i.e, the Scottish Government, Welsh Government and the department of agriculture, environment and rural affairs) working with industry and local councils to identify these methods from across the UK's largest industries, according to an official release.

The collaborative approach will also give industry greater certainty to support investment that will drive forward innovation in cleaner technologies, the release said.

A new governance structure will be established, with new independent bodies, called the Standards Council and the Regulators Group, consisting of government officials and expert regulators from all four nations of the UK.

Read More

Fibre2Fashion, 04-09-22

https://www.fibre2fashion.com/news/textile-news/uk-announces-new-bat-framework-to-tackle-industrial-emissions-282873-newsdetails.htm

Switzerland: 25% of PVC lid gaskets exceed plasticizer migration limits

2022-09-16

In a short communication article published on August 10, 2022, in the journal Food Packaging and Shelf Life, Maurus Biedermann and co-authors from the Official Food Control Laboratory of the Canton of Zurich, Switzerland, share the results of a Swiss national campaign on the compliance of migration of plasticizers from the gaskets for lids into oily food in glass jars. The campaign is a follow-up to two pan European campaigns conducted in 2012 and 2015 that observed one-quarter to

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 30, 2022

one-third of analyzed samples to be non-compliant with the specific migration level (SML) as prescribed by the regulation for plastic food contact materials (Regulation (EU) No 10/2011).

In the current campaign, all 20 local food safety enforcement authorities in Switzerland as well as the authority of Liechtenstein took a total of 109 food samples containing free edible oil packaged in glass jars. Samples were stored for 6 months or until the best-before date and shaken once a month before chemical analysis. Four analytical methods were applied to analyze all plasticizers in food, investigating (i) epoxidized soybean oil (ESBO), (ii) polyadipates (PA), (iii) remaining more volatile plasticizers, and (iv) the composition of the gasket. To assess the samples' regulatory compliance, measured individual plasticizer levels were compared to their respective SML as prescribed by Regulation (EU) No 10/2011. The sum of all approved plasticizers was also evaluated against its approved limit of 60 mg/kg food.

Although they tried to avoid sampling lids with gaskets made out of materials other than polyvinyl chloride (PVC), the authors reported that 26% of the samples were found not to be made of PVC . Compared to the two campaigns run a decade ago, the proportion of non-PVC sealing plastics was higher in the current campaign. According to Biedermann et al., this also resulted in a higher proportion of compliant samples in the current compared to the previous campaigns. A study performed in 2021 analyzing cap gaskets of bottled beverages from 141 brands found that 66% of the cap liners were made of PVC and gaskets of 50 brands contained ortho-phthalates (FPF reported).

Concerning the samples with PVC-based sealant, Biedermann and co-authors reported that the proportion of non-compliant samples was similar between the current and the previous campaigns. Of the 109 foods, 27 were not compliant with Regulation (EU) No 10/2011 since migration was exceeded for ESBO (11 samples), PA (3 samples), acetyltributylcitrate (ATBC, CAS 77-90-7, 3 samples), di-(2-ethylhexyl)-terephthalate (DEHP, CAS 117-81-7, 2 samples), and/or the sum of approved plasticizers (25 samples). Moreover, three samples had unauthorized plasticizers migrating into the food which also resulted in their non-compliance. Overall, samples from smaller food producers more often exceeded regulatory SML than those from larger supermarket chains or brands.

Read More

Food Packaging Forum, 16-09-22

https://www.foodpackagingforum.org/news/switzerland-25-of-pvc-lid-gaskets-exceed-plasticizer-migration-limits

Drinking Water Quality remains high across Northern Ireland

2022-09-22

The Drinking Water Inspectorate (DWI), which is responsible for regulating drinking water quality, has today published its Annual Report for 2021. It states that drinking water quality in Northern Ireland is of a high standard.

Northern Ireland Water Limited (NI Water) is required to undertake a stringent monitoring programme to verify that the tap water it supplies to consumers meets all the stringent quality standards set by the drinking water regulations. During 2021, over 95,000 tests were completed. As outlined in the DWI Report, the overall compliance for the mains water supply in 2021 was 99.88%. The results are based on samples taken from water treatment works, service reservoirs and consumers' taps.

Welcoming publication of the report, Environment Minister Edwin Poots MLA, said: "I am pleased to endorse the Drinking Water Inspectorate's annual report on Drinking Water Quality in Northern Ireland. The quality of our drinking water remains high which is vital for Public Health, the hospitality sector, farming and the economy."

Read More

Gov.uk, 22-09-22

https://www.daera-ni.gov.uk/news/drinking-water-quality-remains-high-across-northern-ireland-3

INTERNATIONAL

The update of the ZDHC MRSL Version 2.0 to Version 3.0 includes several new restrictions including on all PFAS used for textile, footwear, and leather treatments.

2022-09-19

Today ZDHC announces harmful chemical substances to be added to the ZDHC Manufacturing Restricted Substances List (ZDHC MRSL) in Version

CHEMWATCH
Bulletin Board
Regulatory Update
SEP. 30, 2022

3.0 including PFAS treatments used for textiles, leather, and footwear. This announcement highlights the expected changes for MRSL Version 3.0 which will be released on the Roadmap to Zero website (www.roadmaptozero.com).

The updated ZDHC MRSL V3.0 will be published by ZDHC on 1 November 2022 with a transition period of 12 months for effective implementation by all stakeholders.

The ZDHC MRSL is a living document, and is updated as needed following the published MRSL Principles and Procedures (PnP) document.

"The new ZDHC MRSL Version 3.0 sets a clear and unified signal from the apparel and footwear sector of the chemistries that need to be avoided across this and other manufacturing sectors as well as where innovation is needed. The restriction on all PFAS for textile, leather, and footwear finishing is consistent with growing scientific and policy concerns about the impacts of the class of PFAS chemicals. We look forward to working with ZDHC in growing the commercialisation, adoption, scale of safer, more sustainable chemistries and materials to address the toxicity, biodiversity, and climate impacts of our current generation of chemicals."

- Joel Tickner, ScD, Professor of Public Health UMass Lowell and Executive Director Green Chemistry & Commerce Council."

Read More

Road Map to Zero, 19-09-22

https://www.roadmaptozero.com/post/zdhc-announces-the-update-to-its-mrsl-in-version-3-0

The update of the ZDHC MRSL Version 2.0 to Version 3.0 includes several new restrictions including on all PFAS used for textile, footwear, and leather treatments.

Cancer-causing PAHs in clay targets need an EU-wide ban

2022-09-22

ECHA's Committee for Risk Assessment (RAC) supports the proposal to restrict polycyclic aromatic hydrocarbons (PAHs) in clay targets for shooting. The restriction aims to prevent further environmental emissions of these toxic and very persistent substances that build up in humans and animals. Many PAHs are also known to cause cancer.

Helsinki, 20 September 2022 – RAC has adopted its opinion on ECHA's proposal to restrict the placing on the market and use of substances containing PAHs in clay targets for shooting. The proposed restriction introduces a 0.005 % weight by weight concentration limit for the sum of 18 indicator PAHs after a one-year transition with a 1 % concentration limit. PAHs are contained in binders used to produce clay targets.

The committee considered that the restriction proposal is clear and well justified. Although the European Commission had previously refused an authorisation for one of the PAH-containing binders – coal tar pitch, high temperature (CTPHT) – environmental pollution could still continue from imported products and clay targets manufactured with other binders containing PAHs, such as petroleum pitch. This supports the need for further risk management.

"At least 270 tonnes of PAHs per year are estimated to be released to the environment from PAH-containing clay targets. And these are shattered by the gunshot into the open environment with little possibility of applying risk management measures. The proposed restriction will reduce the identified risks by 99 % in a reasonable timeframe," says Tim Bowmer, Chair of the RAC, in a new episode of the Safer Chemicals podcast.

In addition to the environmental risks, RAC considers that a restriction is justified as it will reduce exposure and related cancer risk for workers and the public handling and shooting clay targets.

Read More

ECHA, 22-09-22

https://echa.europa.eu/-/cancer-causing-pahs-in-clay-targets-need-an-eu-wide-ban

CHEMWATCH
Bulletin Board
REACH Update
SEP. 30, 2022

Non-standard studies contribute to over half of REACH restrictions

2022-09-20

In an article published on September 5, 2022, in the journal Environmental Sciences Europe, Flora Borchert and co-authors from Stockholm University and the Karolinska Institutet, Stockholm, Sweden, investigated the use of scientific evidence to restrict chemicals under REACH. The authors wanted to (i) find out which types of key studies the Committee for Risk Assessment (RAC) hosted by the European Chemicals Agency (ECHA) uses to restrict hazardous substances, (ii) "analyse if the REACH registration database provided the key studies used in these restrictions, and (iii) investigate potential disagreements between experts related to the use of non-standard studies in the restrictions." Standardized studies use test methods approved for regulatory use by the ECHA or following internationally validated standardized test guidelines (e.g. from the OECD, ISO), while non-standard studies follow other protocols. In contrast to standard studies which are considered suitable for regulatory assessment by default, the suitability of non-standard studies is less clear leading to debate within the scientific community over their suitability in risk assessments.

In the first six month of 1021, Borchert and co-authors identified the REACH restrictions in which RAC supported the proposed restriction and provided at least one key study (i.e., assessing (eco)toxicological hazard(s)) leading to the restriction. This process led to the selection of 18 RAC opinions supported by 53 key studies in total. The authors found that 58% of the 53 key studies were non-standard studies showing that these contribute to or are even "indispensable" in the identification and management of hazardous chemicals under REACH. The non-standard studies were used in 11 of the 18 analyzed RAC opinions with seven opinions only using non-standard studies. Moreover, 30% of the key studies were not included in the REACH registration database with the majority of them being non-standard studies. Therefore, "the REACH registration database does not contain all data relevant to the restriction of hazardous chemicals." The scientists further reported that 9% of the key studies (all standard studies) were not publicly available indicating a lack of transparency in REACH restrictions. This makes it impossible for third parties to examine REACH registration data and retrace RAC decision-making.

REACH Update

SEP. 30, 2022

Read More

Food Packaging Forum, 20-09-22

https://www.foodpackagingforum.org/news/non-standard-studies-contribute-to-over-half-of-reach-restrictions

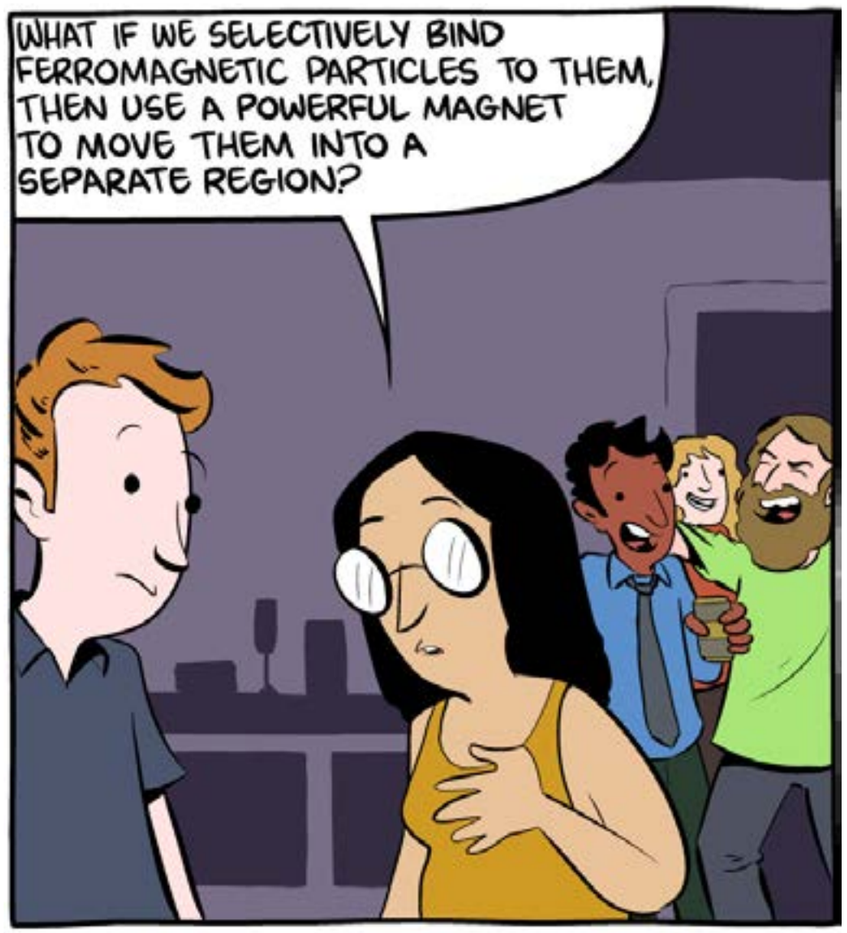
CHEMWATCH
Bulletin Board

Janet's Corner

SEP. 30, 2022

Ferrofluids

2022-09-30



Thanks to chemistry, we discovered the most subtle way to remove unwanted guests.

https://www.smbc-comics.com/comic/ferrofluids

Antimony

2022-09-30

Antimony is a chemical element with symbol Sb and atomic number 51. [1] It is semimetallic chemical element, which can exist in two forms: the metallic form is bright, silvery, hard and brittle; the non-metallic form is a grey powder. Antimony is a poor conductor of heat and electricity; it is stable in dry air and is not attacked by dilute acids or alkalis. Antimony and some of its alloys expand on cooling. [2]

USE [3]

Antimony is mixed into alloys and used in lead storage batteries, solder, sheet and pipe metal, motor bearings, castings, semiconductors, and pewter. Antimony oxide is added to textiles, plastics, rubber, adhesives, pigments and paper to prevent them from catching fire. It is also used in paints, ceramics, ammunition and fireworks, and as enamels for plastics, metal, and glass. Antimony compounds also find medical uses.

SOURCES OF EMISSION & ROUTES OF EXPOSURE

Sources of Emission [3]

- Industry sources: Antimony oxides can be released as a by-product of smelting lead and other metals (emissions to air, land or water), and coal-fired power plants (emissions to air and land).
- Diffuse sources: Refuse incinerators, small industrial facilities involving lead casting etc, and burning of fossil fuels, e.g. for home heating (emissions to air and land).
- Natural sources: Antimony ores occur naturally in the earth's crust. Volcanoes can release antimony oxides into the environment. Antimony is a common component of coal and petroleum.
- Transport sources: Emissions result from vehicle exhaust.
- Consumer products: Products such as plastics, textiles, rubber, adhesives, pigments and paper. Antimony alloys are found in solder, sheet, pipe, bearing and type metals, and castings.

Routes of Exposure [4]

- As antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air.

Antimony is a chemical element with symbol Sb and atomic number 51.

CHEMWATCH
Bulletin Board
Hazard Alert
SEP. 30, 2022

- It may be found in air near industries that process or release it, such as smelters, coal-fired plants, and refuse incinerators.
- In polluted areas containing high levels of antimony, it may be found in the air, water, and soil.
- Workers in industries that process it or use antimony ore may be exposed to higher levels.

HEALTH EFFECTS [5]

Acute Effects

- The only effects reported from acute exposure to antimony by inhalation in humans are effects on the skin and eyes. Skin effects consist of a condition known as antimony spots, which is a rash consisting of pustules around sweat and sebaceous glands, while effects on the eye include ocular conjunctivitis.
- Oral exposure to antimony in humans has resulted in gastrointestinal effects.
- Animal studies have reported effects on the lungs, cardiovascular system, and liver from acute exposure to high levels of antimony by inhalation.
- Antimony is considered to have high acute toxicity based on short-term oral tests in rats, mice, and guinea pigs.

Chronic Effects

- The primary effects from chronic exposure to antimony in humans are respiratory effects that include antimony pneumoconiosis (inflammation of the lungs due to irritation caused by the inhalation of dust), alterations in pulmonary function, chronic bronchitis, chronic emphysema, inactive tuberculosis, pleural adhesions, and irritation.
- Other effects noted in humans chronically exposed to antimony by inhalation are cardiovascular effects (increased blood pressure, altered EKG readings and heart muscle damage) and gastrointestinal disorders.
- Animal studies have reported effects on the respiratory and cardiovascular systems and kidney from chronic inhalation exposure. Oral animal studies have reported effects on the blood, liver, central nervous system (CNS), and gastrointestinal effects.
- A National Toxicology Program (NTP) 14-day drinking water study of potassium antimony tartrate reported an increase in relative liver and kidney weights in the high dose group (females only).

- A 13-week intraperitoneal injection study, also by the NTP, reported inflammation and/or fibrosis of the liver in mice dosed with potassium antimony tartrate.
- EPA has not established a Reference Concentration (RfC) for antimony. However, EPA has established an RfC of 0.0002 milligrams per cubic metre (mg/m3) for antimony trioxide based on respiratory effects in rats.
- The Reference Dose (RfD) for antimony is 0.0004 milligrams per kilogram body weight per day (mg/kg/d) based on longevity, blood glucose, and cholesterol in rats.

Reproductive/Developmental Effects

- An increased incidence of spontaneous abortions, as compared with a control group, was reported in women working at an antimony plant.
- Disturbances in the menstrual cycle were reported in women exposed to various antimony compounds in a metallurgical plant. However, the study that reported these findings was unclear about concurrent exposure to other chemicals, nor did it provide the characteristics of the controls used.
- Animal studies have reported a decrease in the number of offspring born to rats exposed to antimony prior to conception and throughout gestation.
- Reproductive effects, including metaplasia in the uterus and disturbances in the ovum-maturing process, were reported in a rat study, following inhalation exposure.

Cancer Risk

- In one human study, inhalation exposure to antimony did not affect the incidence of cancer in workers employed for 9 to 31 years.
- Lung tumours have been observed in rats exposed to antimony trioxide by inhalation.
- EPA has not classified antimony for carcinogenicity.

SAFETY [6]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

CHEMWATCH
Bulletin Board
Hazard Alert
SEP. 30, 2022

- 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.
- 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: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Expsoure Controls & Personal Protection

Engineering Controls

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

Personal Protective equipment

The following personal protective equipment is recommended when handling antimony:

- Splash goggles;
- Lab coat;
- Dust respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves.

Personal Protective Equipment in Case of a Large Spill:

- Splash goggles;
- Full suit;
- Dust respirator;

- Boots;
- Gloves;
- A self-contained breathing apparatus should be used to avoid inhalation of the product.
- Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

REGULATION

United States [7]

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
OSHA Permissible Exposure Limit (PEL) - General Industry See29 CFR 1910.1000 Table Z-1	0.5 mg/m3 TWA	HE3	Chronic poisoning, functional disorders of the heart, degeneration of the heart muscle
OSHA PEL -Construction Industry See 29 CFR 1926.55 Appendix A	0.5 mg/m3 TWA	HE3	Chronic poisoning, functional disorders of the heart, degeneration of the heart muscle
OSHA PEL - Shipyard Employment See 29 CFR 1915.1000 Table Z-Shipyards	0.5 mg/m3 TWA	HE3	Chronic poisoning, functional disorders of the heart, degeneration of the heart muscle
National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL)	0.5 mg/m3 TWA	HE3	Heart muscle changes, heart disease
		HE5	Spontaneous late abortion, premature birth, gynaecologic problems
		HE10	Pneumoconiosis

CHEMWATCH
Bulletin Board
Hazard Alert
SEP. 30, 2022

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2001)	0.5 mg/m3 TWA	HE15	Skin and upper respiratory tract irritation
CAL/OSHA PEL	0.5 mg/m3 TWA	HE15	Upper respiratory tract irritation

Australia [3]

Safe Work Australia has set an eight-hour time weighted average (TWA) exposure limit for antimony of 0.5 mg/m3

Australian Drinking Water Guidelines (NHMRC and ARMCANZ, 1996):

Maximum of 0.003 mg/L (i.e. 0.000003 g/L)

REFERENCES

1. https://en.wikipedia.org/wiki/Antimony
2. http://www.lenntech.com/periodic/elements/sb.htm
3. http://www.npi.gov.au/resource/antimony-and-compounds
4. http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=331&tid=58
5. http://www3.epa.gov/airtoxics/hlthef/antimony.html
6. http://www.sciencelab.com/msds.php?msdsId=9927438
7. https://www.osha.gov/dts/chemicalsampling/data/CH_219100.html

New Study Reveals How Music Can Help People With Dementia

2022-09-18

Dementia patients often lose their ability to communicate verbally with loved ones as the condition progresses. However, a recent study by Northwestern Medicine and the Institute for Therapy through the Arts (ITA) demonstrates how this gap can be overcome with a novel music intervention.

In the intervention, which was developed at ITA and named "Musical Bridges to Memory", a live ensemble plays music from a patient's youth such as songs from the musicals "Oklahoma" or "The Sound of Music." According to the study's authors, this builds an emotional connection between a patient and their caregivers by enabling them to participate together in musical activities such as singing, dancing, and simple instrument playing.

Additionally, the program improved patients' social engagement and decreased neuropsychiatric symptoms including agitation, anxiety, and depression in both patients and caregivers.

It is currently estimated that Alzheimer's affects more than 6 million individuals in the United States alone.

According to the research's lead author, Dr. Borna Bonakdarpour, the study is unique since it targeted both dementia patients and the caregivers who support them. The majority of earlier research on music therapy for dementia patients has only focused on the patients.

"Patients were able to connect with partners through music, a connection that was not available to them verbally," said Bonakdarpour, an associate professor of neurology at Northwestern University Feinberg School of Medicine and a Northwestern Medicine neurologist. "The family and friends of people with dementia also are affected by it. It's painful for them when they can't connect with a loved one. When language is no longer possible, music gives them a bridge to each other."

The study was recently published in the journal Alzheimer Disease and Associated Disorders.

Musical memory and processing are not as affected by Alzheimer's

Music memories often remain in the brain even as language and other memories disappear in dementia, Bonakdarpour said. This is because

A novel music intervention fosters an emotional connection between patients and their caregivers.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

regions of the brain that are involved in musical memory and processing (e.g., the cerebellum) are not as affected by Alzheimer's or dementia until much later in the disease course. Thus, patients can retain the ability to dance and sing long after their ability to talk has diminished.

How the study worked

In the study, individuals with dementia — residents of Silverado Memory Care (in a suburb of Chicago) — and their care partners were recorded on video conversing and interacting for 10 minutes before and 10 minutes after the intervention. Before playing the music, each patient/caregiver pair had training on how to interact more effectively during the music.

During the 45-minute musical intervention, an ensemble of chamber musicians and a singer performed songs that appealed to the patients from their younger days. The patients and their caregivers received simple instruments such as tambourines and shakers to accompany the music. Specially trained music therapists interacted with patients during performances, getting them to beat on drums, sing and dance.

A group conversation followed the music. Patients were more socially engaged as evidenced by more eye contact, less distraction, less agitation, and an elevated mood. In comparison, the control group, which did not receive the intervention and were exposed to usual daily care and programs, did not show such changes within the same time frame.

The program included 12 sessions over three months.

"All could relate to their loved one"

Before the intervention, some individuals would not communicate much with their partners. However, during the intervention, they started to play, sing and dance together, which was a significant change for the family. These changes generalized to their behavior outside the sessions as well.

"As the program progressed, caregivers invited multiple family members," said Jeffrey Wolfe, a neurologic music therapist-fellow at ITA and leader of the Musical Bridges to Memory program. "It became a normalizing experience for the whole family. All could relate to their loved one despite their degree of dementia."

The next step in the research is to conduct the study on a larger group of patients. ITA and Northwestern have been funded by a three-year grant through the National Endowment for the Arts to expand this study.

Sci Tech Daily, 18 September 2022

https://scitechdaily.com

Algerian pharmaceutical boom: A step towards health & food security

2022-09-19

In just a few decades, Algeria has become one of Africa's leading pharmaceutical producers. More than 2.5 billion euros worth of medicines were produced last year. Some 200 production units cover nearly 70% of the country's generic needs, and this self-sufficiency is good news for the country and the region, as the international market remains volatile.

This deep transformation in the pharmaceutical industry is strengthening the region's health security, which may in turn, help to provide food security and many labaroties around the country are participating in the effort.

Frater Razes Laboratories

An example is the Frater Razes laboratories. In the midst of the pandemic, it put on the market an anticoagulant which was prescribed to Covid-19 patients. This was the first time that Algeria produced biosimilar medicines: made from living organisms. Abdererahmane Boudiba is the Secretary General of Frater Razes,

"The world today is moving towards biotechnology. We have anticipated this trend in the same way as international laboratories through pharmaceutical innovation, by orienting our production towards biosimilars and the creation of products from cell culture. This product had been imported for 20 years. We have ensured self-sufficiency for our country, for Algerian patients."

The laboratory now plans to increase its exports. But another priority is to take further step towards self-sufficiency, and thanks to its research it hopes it will soon be able to synthesise organic substances. Hamza Mansour is the Managing Director,

This deep transformation in the pharmaceutical industry is strengthening the region's health security, which may in turn, help to provide food security.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

"If we carry out this biosynthesis, we will not have to import raw materials. We will manufacture our own raw materials, we will ensure our biosynthesis, our manufacturing from A to Z."

Several reforms have brought about a paradigm shift in the country, where health products have gone from being an economic burden to a lever for growth.

Biopharm Research and Development

Biopharm is another private laboratory that has recently started marketing oncology products, anticancer drugs, whose development requires complex infrastructures and massive investments. Ayadi El-Ghani is the Production Manager,

"It is important to know that the pharmaceutical industry is the locomotive of the Algerian general industry in Algeria. It is an industry that has experienced double-digit growth for the past twenty years. The challenge is now to acquire the know-how for the production of new technologies. We have the ambition for next year to move into hormonology. And why not move on to biological drugs in the near future?"

In the research and developements laboratory at Biopharm it is developing its next products in collaboration with the Algerian scientific and academic community. The aim is to develop an industry that is comparatively young on a global scale.

But while the Algerian pharmaceutical sector currently covers 70% of the needs of the Algerian population in generic medicines, how to produce the remaining 30%? We asked Idir Boutmeur, who is the Head of the R&D centre at Biopharm,

"The remaining 30% are products that are quite difficult to develop, innovative products. Everything depends on innovation, which is the key to the success of any industry, and in order to find these products, we have to invest in human resources, in premises, in Research and Development centres."

Biocare: first African company to produce insulin

A few kilometres away, the firm Biocare has become the first company in Africa to manufacture insulin in pen form. This has once again reduced the import bill as diabetes care is one of the main items of expenditure for Algerian social security. Abdelkader Amraoul, is the General Manager,

"This is a unique technique and technology on our African continent. It is a vital product for the Algerian patient and the patient of our African continent."

Saidal Public Laboratory & Food Security

To give life to its health strategy, Algeria relies on the public laboratory Saidal. It was one of the first in Africa to produce an anti-Covid vaccine, Coronavac, in collaboration with China. The company is looking towards Africa and supporting the development of an integrated continental industry, with specialised regional hubs. Fetoum Akacem is the CEO of the Saidal Group,

"Our African partners are becoming more demanding and want a part of the pharmaceutical industry to be present in their countries. And Saidal can offer this. You know, 'when your health goes, everything goes'. So, when we start giving this health security to the populations, food security will certainly follow. And these are the two most important areas for developing Africa and Algeria.

One of the challenges will be to convince the major medicine donors, such as the World Health Organisation, to buy African medicines in order to create added value on the continent.

Euronews, 19 September 2022

https://euronews.com

Bioelectronic face mask can detect COVID-19 in real time, scientists say

2022-09-20

Scientists say they have invented a face mask that can tell you if COVID-19 is in the air.

The mask uses a biosensor that can detect respiratory viruses in air droplets, according to a study published in peer-reviewed science journal Matter.

The sensor attached to the mask detected as little as 0.3 microlitres of liquid containing the virus, about 70 to 560 times less than the volume of liquid produced in one sneeze.

It then sends a phone alert to the wearer to tell them they have been exposed.

The mask contains similar technology to that used by a Harvard laboratory that created a mask with an in-built COVID test.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

Conventional face masks have been proven to reduce the risk of COVID as a barrier and filter to pathogens and germs.

The study's co-author, Dr Yin Fang from Shanghai's Tongji University, said the bioelectronic mask could be adapted to detect emerging viruses, and prevent future outbreaks.

"Our mask would work really well in spaces with poor ventilation, such as elevators or enclosed rooms, where the risk of getting infected is high," he said.

The sensor uses synthetic molecules that can be designed to target specific pathogens — in this case, COVID and two influenza strains.

If these are detected, a wireless device embedded in the mask sends an alert to the wearer's phone.

Similar technology was used by researchers at a Harvard laboratory in the US, where biosensors were embedded in N95 masks to create an in-built COVID test.

University of Technology Sydney infection control expert Marilyn Cruickshank said this latest development from China was a "promising first step", but its success would depend on how it was rolled out.

"I can see that there is great potential, but it would need some good education and implementation strategies — like most novel approaches, it's all about implementation," she said.

"People have to wear them, they have to know what they need to do if they are exposed to do it — because knowing that you've breathed it in is only the first step.

"There needs to be a whole process behind what happens if you get this result."

Dr Yang said the new masks would help doctors diagnose illnesses faster.

"Currently, doctors have been relying heavily on their experiences in diagnosing and treating diseases," he said.

"But with richer data collected by wearable devices, disease diagnosis and treatment can become more precise."

ABC News, 20 September 2022

https://abc.net.au

Hydrogels pave the way for the future of soft robotics

2022-09-19

Researchers in Carnegie Mellon University's College of Engineering have created an open-source, commercially available fiber extruder to benefit future research with hydrogels and soft robotics.

As their name suggests, hydrogels begin in liquid form as monomers. This viscous liquid, which can be made of synthetic or natural materials from polyester to sodium alginate, can be used as ink for 3D printing. The ink is first loaded into a syringe, then pumped through the needle as a thin filament and solidified following 3D printing to form a multidimensional structure, in the same way that Jell-O is mixed up first as a liquid before turning into a soft, bendable dessert. When hydrogels are placed in the right environment, the monomers in the liquid crosslink to form polymers, which gives shape to the hydrogel and lets it trap water.

You might imagine that these supple materials are also delicate—and that's one drawback of working with hydrogels for robotic applications. To solve this problem and allow hydrogels to be used in a greater variety of tasks and harsh environments, Wenhuan Sun, a Ph.D. student in mechanical engineering, co-advised by Victoria Webster-Wood and Adam Feinberg, designed a continuous fiber extruder, a device that reinforces the hydrogels, so they don't easily break apart or lose their shape when loaded. Feinberg, a professor of biomedical engineering and materials science and engineering, previously created the 3D printer that the fiber extruders were first tested on.

Embedding fibers into hydrogels during the printing process reinforces their mechanical properties so they're not as fragile. Creating an open-source, commercially available fiber extruder will benefit future research with hydrogels. Not only is the team's extruder design relatively cheap at about $53, but it's also compatible with many at-home 3D printing devices and has been tested successfully in hydrogels embedded with both synthetic and natural fibers, including silk and collagen. The team's paper, published in HardwareX, serves almost as a formula for other researchers who want to experiment with fiber embedded hydrogel 3D printing.

"This paper describes the entire process of how we built the fiber print hub so that other people can just reference our work and then build their own without additional instruction," Sun says of how their research serves the robotics community.

You might imagine that these supple materials are delicate—and that's one drawback of working with hydrogels for robotic applications.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

When hydrogels maintain their structural integrity, they can be applied to a wider variety of situations. Their unique attributes like flexibility and softness make them ideal tools for drug delivery and tissue engineering, but physical sturdiness opens the door to broader tasks in soft robotics. Since the continuous fiber extruders work well with natural materials like collagen and alginate, reinforced hydrogels are poised to become an adaptable material for soft robots, and they are an environmentally friendly one, too.

"We're really interested in how we can use biodegradable materials in robots," says Webster-Wood, an assistant professor of mechanical engineering who founded the Biohybrid and Organic Robotics Group. "These plant-based hydrogels are a really interesting direction, because we can basically farm the materials for the robots and make them renewable."

Tech Xplore, 19 September 2022

https://techxplore.com

Microbiologists propose new DNA-based naming system for microbes

2022-09-19

A new system for naming certain microbes promises to streamline the process and relieve a backlog created by the thousands of species uncovered through DNA analyses in recent years. In a paper published today in Nature Microbiology, researchers describe SeqCode, a protocol that allows, for the first time, the naming of newly discovered bacteria and other prokaryotes based only on their DNA sequence.

"I do think the SeqCode, or something like it, is necessary for microbiology today, due to the overwhelming dependence now on genomic data for analyzing microorganisms," says Edward Moore, a microbiologist at the University of Gothenburg—but he's still not ready to embrace this particular identification system. Until now, microbiologists seeking acceptance that a seemingly novel single-cell microbe was real have had to follow the protocol outlined in the International Code of Nomenclature of Prokaryotes (ICNP). As part of the process, researchers must succeed in growing the species of bacteria, or other prokaryotes called archaea, in the lab and submit a "type" culture, a living or frozen sample of the microbe that would serve as a reference of its identity, to at least two world's repositories. A published description in a scientific journal is also required

But the field is debating whether a genome alone is enough to say whether a bacterium really exists.

and must be accepted by the International Committee on Systematics of Prokaryotes (ICSP), which administers the ICNP.

However, with the rise of environmental sequencing and metagenomics, in which all the DNA in a sample from the air, water, an animal's gut, or other environment is sequenced and compared with DNA in existing databases to provide insights into what organisms are present, there's been an exponential increase in microbial DNA sequences belonging to no known prokaryote; sometimes researchers can piece together an entire genome but often there are a few pieces possibly missing. An estimated 5000 microbes identifiable only by their DNA are now awaiting attempts to culture them and further characterization. The problem of what to call these new additions "is becoming increasingly difficult," says Gemma Reguera, a microbiologist at Michigan State University who is the editor-in-chief for the American Society for Microbiology's (ASM's) Applied and Environmental Microbiology journal.

The team behind SeqCode developed it as a response to some of these issues. "We needed something easier" than the ICNP protocol, explains William Whitman, a microbiologist at the University of Georgia who spearheaded the development of SeqCode. Researchers who have deposited and published the DNA sequence of a possible new prokaryote file an application through the SeqCode website, no cultures required. The system will automatically check to make sure the sequence is unique by going through existing databases. SeqCode will also require that the proposed name follows certain guidelines—such as being reported in a scientific publication (proposers must include a citation) and following standardized naming procedures that use Latin appropriately.

Whitman's first proposal was to have DNA sequences be accepted as part of the ICSP naming protocol in 2015. In 2020, the idea was put to a vote and rejected three to one by the microbiology community. SeqCode's development as a separate protocol was a response to that vote.

Already, a few microbiologists have begun to use SeqCode. Jeremy Dodsworth, a geomicrobiologist at California State University, San Bernardino, has tentatively bestowed the name Wolframiiraptor gerlachensis on an archaeon from hot springs that relies on tungsten to survive and has several more species from his group's research he plans to enter. He and his colleagues have been able to grow W. gerlachensis in the lab but not by itself, preventing the pure sample needed for the culture collection before it could get a traditional name.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

But it's still unclear whether SeqCode will take hold, says Iain Sutcliffe, a bacteriologist at Northumbria University who also helped develop the alternative. Some microbiologists refuse to accept a genome as sufficient evidence of a species' existence because the organism is not physically identified and grown in a lab. "Newly discovered but not cultured microbes are simply hypothetical microbes," Moore says.

Although Moore acknowledges the need to incorporate the boom in DNA-based discovery of bacterial species into the field, he doesn't think it's necessary—or practical—to assign full Latin-derived names to the thousands of microbes because of the work involved. He favors a numerical classification system instead.

For now, the old and new naming systems will run in parallel so microbiologists can use either one, but Whitman hopes eventually they will merge into one. Moore doesn't see that happening, as "the rules of the ICNP and the rules of the SeqCode conflict with each other," he says.

Reguera says she and other journal editors at ASM will have to evaluate SeqCode further to decide whether and how to use it. Personally, she's sold. "I am eager to give it a try," and she expects so will many microbial ecologists. Sutcliffe, though hopeful, is not sure what will happen. "Only time will tell as to whether the wider community will make use of SeqCode."

Science, 19 September 2022

https://science.org

First public global database of fossil fuels launches

2022-09-20

A first-of-its-kind database for tracking the world's fossil fuel production, reserves and emissions launched on Monday to coincide with climate talks taking place at the United Nations General Assembly in New York.

The Global Registry of Fossil Fuels includes data from over 50,000 oil, gas and coal fields in 89 countries, covering 75% of global reserves, production and emissions. The tool is available for public use, a first for a collection this size.

There was already private data available for purchase, and analysis of the world's fossil fuel usage and reserves. The International Energy Agency also maintains public data on oil, gas and coal, but it focuses on the

Users can see the carbon dioxide emissions they would generate if burned — at a global, country or field level.

demand for those fossil fuels, whereas the new database includes fuels still underground.

The registry was developed by Carbon Tracker, a nonprofit think tank that researches the energy transition's effect on financial markets, and Global Energy Monitor, an organization that tracks a variety of energy projects around the globe.

It allows anyone with a computer and internet access to look at coal, oil and gas reserves with a resolution that hasn't been possible before. Users can see the carbon dioxide emissions they would generate if burned — at a global, country or field level.

They can get a sense of the role fossil fuel production has played in different economies. They can simulate transitioning away from fossil fuels under four scenarios: continuing current trends, governments keeping pledges they've made, governments following sustainable development goals set by the United Nations, and the world achieving net zero by 2050.

"It is a first-ever full transparency, open source, available-to-all kind of tool," said Inger Andersen, executive director of the United Nations Environment Program, in a press briefing about the registry on Monday. "And as you build it out, we from UNEP will be mining it for every bit we can find, so that we, too, can use it."

Mark Campanale, founder of Carbon Tracker, said he hopes the registry will empower groups to hold governments accountable, for example, when they issue licenses for fossil fuel extraction.

"Civil society groups have got to get more of a focus on what governments are planning to do in terms of license issuance, both for coal and oil and gas, and actually begin to challenge this permitting process," Campanale told The Associated Press.

The release of the database and an accompanying analysis of the collected data coincide with two sets of climate talks at the international level — the U.N. General Assembly in New York that opened Monday, and COP27 in Sharm El Sheikh, Egypt, in November. The Data like what's being released in the registry could arm environmental and climate groups to pressure national leaders to agree to stronger policies that result in less carbon emissions.

And we're in dire need of carbon reductions, Campanale said.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

In their analysis, the developers found that the United States and Russia have enough fossil fuel underground to exhaust the world's remaining carbon budget. That's the carbon the world can afford to emit before a certain amount of warming occurs, in this case 1.5 degrees Celsius. It also shows these reserves would generate 3.5 trillion tons of greenhouse gas emissions, which is more than all of the emissions produced since the Industrial Revolution.

"We already have enough extractable fossil fuels to cook the planet. We can't afford to use them all — or almost any of them at this point," said Rob Jackson, a Stanford University climate scientist who was not involved with the database.

"I like the emphasis on transparency in fossil fuel production and reserves, down to specific projects. That's a unique aspect to the work."

Jackson compared the global carbon budget to a bathtub.

"You can run water only so long before the tub overflows," he said. When the tub is close to overflowing, he said, governments can turn down the faucet (mitigating greenhouse gas emissions) or open the tub's drain more (removing carbon from the atmosphere).

Campanale said the hope is the investment community, "who ultimately own these corporations," will use the data to begin to challenge the investment plans of companies still planning to expand oil, gas and coal projects.

"Companies like Shell and Exxon, Chevron and their shareholders can use the analysis to to really begin to try and push the companies to move in a completely different direction."

AP News, 20 September 2022

https://apnews.com

Octopuses have preferred arms – just like us

2022-09-21

Researchers studying octopuses to enhance knowledge about how to build useful underwater robots have come up with a surprise finding: cephalopods prefer some arms over others.

University of Minnesota scientists watched octopuses for hours: "Normally when you look at an octopus for a short while, nothing is repeatable," said

Trevor Wardill, an assistant biology professor who studies octopuses and other cephalopods.

"They squirm around and just look weird in their exploratory movements."

The new study, published in Current Biology looked at 10 California two-spot octopuses (Octopus bimaculoides), a yellow, tennis-ball sized creature which lives for around two years.

In an observing arena with just a fake plant and den, the octopuses were given live prey – either shrimp or fiddler crabs – and 628 predatory behaviours were captured on video. To make it easier to track, the arms were numbered on each side of the octopus' body.

From this, the researchers analysed which arms were used more often, as well as the way that the remaining arms were incorporated.

Because crabs move slowly while shrimp can flick their tails to escape quickly, each type of prey potentially requires different hunting tactics.

The researchers found a couple of surprises. Firstly, the octopuses had a favourite arm – no matter the prey, octopuses seem to prefer using their second arm from the middle.

They also discovered that octopuses would normally use the arm on the same side as the eye viewing the prey.

Finally, to avoid spooking the prey, they would lead with their favourite arm and after making contact with the shrimp, they used neighbouring arms one and three to make sure it didn't escape.

"Our study corroborates a previous report that side preference for eye and arm use is highly correlated," the team write in their new paper.

"We found that the division of labour among the eight arms during monocular attack follow a simple topological rule where proximity of the prey to the viewing eye dictates whether arm recruitment is [on the same side of the body or opposite.]"

Interestingly, unlike human handedness, the researchers suggest that although there is a slight side bias, the eight arms of an octopus are mostly mirrored, and are "functionally equivalent" to capture prey.

"To some extent, this organization can be seen as the Hominidae fingers where each digit of the left and the right hand are the mirror of each other and skilled for individuated finger movements," they add.

The second arm from the middle is the attacking arm.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

Wardill and the team are not just looking at this for interests' sake. They suggest that understanding how this works – down to the neurons – could allow better designed robots.

"Octopuses are extremely strong. For them, to grasp and open a door is trivial, given their dexterity. If we can learn from octopuses, then we can apply that to making an underwater vehicle or soft robot application," he said.

The research has been published in Current Biology.

Cosmos, 21 September 2022

https://cosmosmagazine.com

Botox influences the control of emotions in the brain

2022-09-22

The bacterial toxin botulinum toxin (BTX)—colloquially known as Botox—is probably known to most people as a remedy for wrinkles. But botulinum toxin can do even more: if it is injected into the forehead, for example, it can alleviate depression. It also dampens negative emotions in people with borderline personality disorder, who suffer from extreme mood swings.

Professor Dr. Tillmann Krüger, senior physician and research group leader at the Clinic for Psychiatry, Social Psychiatry and Psychotherapy at the Hannover Medical School (MHH), proved this years ago—together with his colleague Privatdozent (PD) Dr. Marc Axel Wollmer from the Asklepios Campus Hamburg of Semmelweis University. Now the psychiatrists have found out where and how BTX influences the negative program in the brain. With the help of magnetic resonance imaging (MRI), they have visualized the neuronal effects in borderline patients. The result: botulinum toxin influences the so-called amygdala or almond nucleus in the temporal lobe in the brain, where fears arise and are processed. The work was recently published in the journal Scientific Reports.

Feedback between muscles and psyche

Negative moods are expressed on the face in the so-called glabellar region, the area of the lower middle forehead. When we are angry or tense, two different types of muscles contract and cause frown lines or worry lines to appear above the root of the nose. When botulinum toxin is injected into the glabellar region, it paralyzes these muscles between the

Negative moods are expressed on the face in the so-called glabellar region, the area of the lower middle forehead.

eyebrows. Because facial expressions and psychological state are closely linked, this also reduces the intensity of emotions.

"A relaxed forehead conveys a more positive feeling, so to speak," explains Professor Krüger. In science, this feedback is discussed as facial feedback theory. In an earlier meta-analysis, Professor Krüger and his team had already demonstrated that a BTX injection into the glaballar region has a positive influence on mood and mood arousal.

Depressive symptoms improve significantly as a result. "The treatment has several advantages at once: Since the paralyzing effect lasts for three or more months, an injection also only needs to be given at these intervals. The infrequent injections are also less costly than some other therapy options and have a very good tolerance and acceptance among patients," Professor Krüger explains.

Botulinum toxin curbs emotional constant fire in the tonsil nucleus

And this works for depression as well as for borderline personality disorder. About three percent of Germans suffer from this disorder, and more than 62% of those affected are women. By interrupting the feedback loop between the forehead muscles and the brain, botulinum toxin also changes the emotional feedback. The researchers were able to prove this in the brains of borderline patients who had been treated with a botulinum toxin injection in the glabellar region. Just four weeks later, the patients had significantly reduced symptoms, which was also shown in the MRI images.

"We were able to see that botulinum toxin curbs the emotional constant fire in the tonsil nucleus, which accompanies the high-grade inner tension of the affected persons," says the psychiatrist. A comparison group treated with acupuncture also showed improved clinical symptoms, but not the neuronal effects in the MRI examination. However, the feedback between muscles and brain does not only work in the glabellar region.

This is the result of a database study in which Professor Krüger and his colleague Professor Wollmer were involved and which was already published in the journal Scientific Reports at the end of 2021. In collaboration with the University of California San Diego, they found that botulinum toxin can also alleviate anxiety disorders when injected into the head muscles, the muscles of the upper and lower limbs and the neck muscles.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

So far, however, BTX treatment for mental illnesses has not been included in the services provided by health insurance companies. The psychiatrist hopes that this will change when the mode of action has been better researched.

Botulinum toxin, colloquially known as Botox, is the strongest known neurotoxin. It is produced by the bacterium Clostridium botulinum in the absence of air and causes so-called botulism. The symptoms of poisoning are usually caused by eating poorly preserved food in which the bacterial toxin has accumulated. This inhibits the transmission of excitation from nerve cells to other cells, especially at the junctions to muscle and blood.

Medical Xpress, 22 September 2022

https://medicalxpress.com

Scientists find that wolves can show attachment toward humans

2022-09-20

When it comes to showing affection towards people, many dogs are naturals. Now, a new study in the journal Ecology and Evolution reports that the remarkable ability to show attachment behavior toward human caregivers also exists in wolves.

The findings were made when researchers at Stockholm University, Sweden, tested 10 wolves and 12 dogs in a behavioral test specifically designed to quantify attachment behaviors in canids. During this test, 23-week-old wolves spontaneously discriminated between a familiar person and a stranger just as well as dogs did, and showed more proximity seeking and affiliative behaviors towards the familiar person.

Additionally, the presence of the familiar person acted as a social stress buffer for the wolves, calming them in a stressful situation. These discoveries build on a slowly accumulating body of evidence contradicting the hypothesis that the abilities necessary to form attachment with humans, arose in dogs only after humans domesticated them at least 15,000 years ago.

"We felt that there was a need to thoroughly test this," says Dr. Christina Hansen Wheat, Ph.D. in Ethology from Stockholm University, Sweden. "Together with earlier studies making important contributions to this question, I think it is now appropriate to entertain the idea that if variation in human-directed attachment behavior exists in wolves, this behavior

The presence of the familiar person acted as a social stress buffer for the wolves, calming them in a stressful situation.

could have been a potential target for early selective pressures exerted during dog domestication."

Dr. Hansen Wheat is interested in understanding how domestication affects behavior. To study this, she and her team raised wolf and dog puppies from the age of 10 days and put them through various behavioral tests. In one of those tests, a familiar person and a stranger takes turn in coming in and out of a test room to create a somewhat strange and stressful situation for the animal. The theory behind the test, originally developed to assess attachment in human infants, is that by creating this unstable environment, attachment behaviors (such as proximity seeking) will be stimulated.

In essence, what the researchers were looking for in this Strange Situation Test was if the wolves and dogs could discriminate between the familiar person and the stranger. That is, did they show more affection, and spend more time greeting and in physical contact with the familiar person than the stranger. If wolves and dogs would do so equally it would point towards this ability not being unique to dogs, i.e. it has not evolved specifically in dogs.

"That was exactly what we saw," says Dr. Hansen Wheat. "It was very clear that the wolves, as the dogs, preferred the familiar person over the stranger. But what was perhaps even more interesting was that while the dogs were not particularly affected by the test situation, the wolves were. They were pacing the test room."

"However, the remarkable thing was that when the familiar person, a hand-raiser that had been with the wolves all their lives, re-entered the test room the pacing behavior stopped, indicating that the familiar person acted as a social stress buffer for the wolves. I do not believe that this has ever been shown to be the case for wolves before and this also complements the existence of a strong bond between the animals and the familiar person."

Dr. Hansen Wheat adds that similarities between dogs and wolves can tell us something about where the behavior we see in our dogs come from. And, while it may be a surprise to some that wolves can connect with a person in this way, she says in retrospect it also makes sense.

"Wolves showing human-directed attachment could have had a selective advantage in early stages of dog domestication," she says.

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

Dr. Hansen Wheat will now continue to work with the data she and her team have collected over the course of three years hand-raising wolves and dogs under identical conditions to learn even more about their behavioral differences and similarities.

Phys Org, 20 September 2022

https://phys.org

Superconductor Breakthrough: Scientists Discover an Invisible Phenomenon

2022-09-20

It may be possible to develop superconductors that operate at room temperature with further knowledge of the relationship between spin liquids and superconductivity, which would transform our daily lives.

Superconductors offer enormous technical and economic promise for applications such as high-speed hovertrains, MRI machines, efficient power lines, quantum computing, and other technologies. However, their usefulness is limited since superconductivity requires extremely low temperatures. It is highly challenging to integrate them with modern technology because of this demanding and costly requirement.

The discovery is a step towards much more accessible superconductivity.

The electrical resistance of a superconductor has a specific critical temperature beyond which it drops suddenly to zero, unlike an ordinary metallic conductor, whose resistance declines gradually as temperature is reduced, even down to near absolute zero.

The search for superconductors that do not require such low temperatures is the primary objective of current superconductivity research. The mechanism by which these superconductors function is the biggest mystery in this field, to which no one has an answer. Understanding the process that creates superconductivity at high temperatures would allow for more practical applications.

A recent study that was conducted by scientists at Israel's Bar-Ilan University and recently published in the journal Nature makes progress in resolving this ongoing mystery. Using a scanning SQUID (superconducting quantum interference device) magnetic microscope, the researchers photographed a phenomenon that had previously been invisible to other techniques.

Scientists were taken aback when high-temperature superconductors were initially uncovered. Scientists had assumed that good

superconductivity would be found in metals. Contrary to predictions, it was found that insulating ceramic materials are the best superconductors.

Finding properties that are common to these ceramic materials may help identify where their superconductivity originated from and improve control over the critical temperature. One such property is that the electrons in these materials resist each other strongly. They are thus unable to move freely. They are instead trapped inside a periodic lattice structure.

Electrons have two defining properties: their charge (a moving charge results in an electric current) and their spin. Spin is the quantum property of electrons responsible for their magnetic properties. It is as if a tiny bar magnet is attached to each electron. In ordinary materials, the charge and spin are "built-in" to the electrons and cannot be separated.

However, in special quantum materials called "quantum spin liquids", interactions between the electrons enable a unique phenomenon whereby each electron is broken into two particles, one with charge (but no spin) and one with spin (and no charge). Such quantum spin liquids may exist in high-temperature superconductors and, in fact, their existence could explain why the superconductivity in these materials is so good.

The challenge is that these spin liquids are "invisible" to conventional measurements. Even when we suspect a material may be a spin liquid, there is no experiment that could verify it or probe its nature. This is similar to dark matter which doesn't interact with light and is therefore very difficult to detect.

The current study, conducted by Professor Beena Kalisky and doctoral student Eylon Persky from the Physics Department at Bar-Ilan University and their collaborators, is a significant step towards the development of a method to study spin liquids. The researchers examined the properties of a spin liquid by making it interact with a superconductor. They used an engineered material made of alternating atomic layers of the superconductor and the candidate spin liquid.

"Unlike spin liquids which do not generate any signals, superconductors have clear magnetic signatures that are easy to measure. We were, therefore, able to study the properties of the spin liquid by measuring the small changes it generated in the superconductor," says Persky. The researchers used a scanning SQUID – an extremely sensitive magnetic

CHEMWATCH
Bulletin Board
Gossip
SEP. 30, 2022

sensor capable of detecting both magnetism and superconductivity – to investigate the properties of the heterostructure.

"We've observed vortices created in the superconductor. These vortices are circulating electric currents, each holding one quantum of magnetic flux. The only way to create such vortices is by applying a magnetic field, but in our case, the vortices were created spontaneously," explains Kalisky. This observation showed that the material itself generated a magnetic field. The biggest surprise came when this field did not show itself in a direct measurement. "Surprisingly, we found that the magnetic field created by the material was invisible to a direct magnetic measurement," adds Kalisky.

The results pointed to a "hidden" magnetic phase, which was exposed in the experiment through the interaction with the superconducting layer. Collaborating with groups from Bar-Ilan University, the Technion, the Weizmann Institute, the University of California, Berkeley, and the Georgia Institute of Technology, the researchers concluded that this magnetic phase was probably a direct result of the relationship between the spin liquid layer and the superconducting layer. The hidden magnetism is a result of the spin-charge separation in the spin liquid. The superconductor reacts to this magnetism and this generates vortices without the need for a "real" magnetic field.

This is, in fact, the first direct observation of the link between these two phases of matter. These results provide access to the properties of the elusive spin liquids, such as the interactions between the electrons. The results also open the door to engineering additional layered materials, through which the relationship between superconductivity and other electronic phases could be studied. Further studies of the relationship between spin liquids and superconductivity may enable designing superconductors that work at room temperature, and this, in turn, would change our daily lives.

Sci Tech Daily, 20 September 2022

https://scitechdaily.com

Earth harbours 20,000,000,000,000,000 ants – and they weigh more than wild birds and mammals combined

2022-09-20

Have you ever wondered exactly how many ants live on Earth? Possibly not, but it's certainly a question we've asked ourselves.

Our research published today provides an approximate answer. We conservatively estimate our planet harbours about 20 quadrillion ants. That's 20 thousand million millions, or in numerical form, 20,000,000,000,000,000 (20 with 15 zeroes).

We further estimate the world's ants collectively constitute about 12 million tonnes of dry carbon. This exceeds the mass of all the world's wild birds and wild mammals combined. It's also equal to about one-fifth of the total weight of humans.

Eminent biologist Edward O. Wilson once said insects and other invertebrates are "the little things that run the world" – and he was right. Ants, in particular, are a crucial part of nature. Among other roles, ants aerate the soil, disperse seeds, break down organic material, create habitat for other animals and form an important part of the food chain.

Estimating ant numbers and mass provides an important baseline from which to monitor ant populations amid worrying environmental changes.

Counting the world's ants

There are more than 15,700 named species and subspecies of ants, and many others not yet named by science. Ants' high degree of social organisation has enabled them to colonise nearly all ecosystems and regions around the globe.

The astounding ubiquity of ants has prompted many naturalists to contemplate their exact number on Earth. But these were basically educated guesses. Systematic, evidence-based estimates have been lacking.

Our research involved an analysis of 489 studies of ant populations conducted by fellow ant scientists from around the world. This included non-English literature, in languages such as Spanish, French, German, Russian, Mandarin and Portuguese.

The research spanned all continents and major habitats including forests, deserts, grasslands and cities. They used standardised methods for collecting and counting ants such as pitfall traps and leaf litter samples. As you can imagine, this is often tedious work.

Have you ever wondered exactly how many ants live on Earth? Possibly not, but it's certainly a question we've asked ourselves.

From all this, we estimate there are approximately 20 quadrillion ants on Earth. This figure, though conservative, is between two and 20 times higher than previous estimates.

Th previous figures employed a "top-down" approach by assuming ants comprise about 1% of the world's estimated insect population. In contrast, our "bottom-up" estimate is more reliable because it uses data on ants observed directly in the field and makes fewer assumptions.

Our next step was to work out how much all these ants weigh. The mass of organisms is typically measured in terms of their carbon makeup. We estimated that 20 quadrillion average-sized ants corresponds to a dry weight or "biomass" of approximately 12 million tonnes of carbon. This is more than the combined biomass of wild birds and mammals – and about 20% of total human biomass.

Carbon makes up about half the dry weight of an ant. If the weight of other bodily elements was included, the total mass of the world's ants would be higher still.

We also found ants are distributed unevenly on Earth's surface. They vary sixfold between habitats and generally peak in the tropics. This underscores the importance of tropical regions in maintaining healthy ant populations.

Ants were also particularly abundant in forests, and surprisingly, in arid regions. But they become less common in human-made habitats.

Our findings come with a few caveats. For example, the sampling locations in our dataset are unevenly distributed across geographic regions. And the vast majority of samples were collected from the ground layer, meaning we have very little information about ant numbers in trees or underground. This means our findings are somewhat incomplete.

We all need ants

Ants also provide vital "ecosystem services" for humans. For instance, a recent study found ants can be more effective than pesticides at helping farmers produce food.

Ants have also developed tight interactions with other organisms – and some species cannot survive without them.

For example, some birds rely on ants to flush out their prey. And thousands of plant species either feed or house ants in exchange for protection, or dispersal of their seeds. And many ants are predators, helping to keep populations of other insects in check.

Alarmingly, global insect numbers are declining due to threats such as habitat destruction and fragmentation, chemical use, invasive species and climate change.

But data on insect biodiversity is alarmingly scarce. We hope our study provides a baseline for further research to help fill this gap.

It's in humanity's interest to monitor ant populations. Counting ants is not difficult, and citizen scientists from all over the world could help investigate how these important animals are faring at a time of great environmental change.

The Conversation, 20 September 2022

https://theconversation.com

Mangroves keep carbon in the soil for 5,000 years

2022-09-20

On top of all the other dazzling biology, mangrove forests are massive carbon sinks.

In fact, according to new research on a Mexican mangrove forest, they can keep carbon out of the atmosphere for millennia.

A study published in Marine Ecology Progress Series has found that the carbon stored in peat under the mangrove forest is over 5,000 years old.

"What's special about these mangrove sites isn't that they're the fastest at carbon storage, but that they have kept the carbon for so long," says co-author Emma Aronson, an associate professor in microbiology and plant pathology at the University of California, Riverside, US.

"It is orders of magnitude more carbon storage than most other ecosystems in the region."

It's well-known that mangroves, like other plant ecosystems, are good at absorbing CO2 from the atmosphere and storing it in soil, with the help of a range of different microbes.

In a wet, oxygen-low environment – like under mangrove forests – the organic matter can form carbon-rich peat.

Marine forests are great long-term carbon sinks.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

But soil carbon storage is rarely permanent: over decades or centuries, the carbon is cycled back into the atmosphere. (To learn more, read our explainer on soil carbon storage.)

The researchers set out to examine the microbial life, as well as the carbon and nitrogen storage, of marine mangrove forests near La Paz in Mexico.

They used radiometric dating to figure out the age of the peat, placing the oldest at 5000 years, give or take about a century.

This extreme age surprised the researchers – while it's not as old as the peat under Artic or Antarctic permafrost, it's much older than surrounding ecosystems.

They're now hoping to examine other mangrove sites in North and Central America to see whether they have similarly ancient carbon.

"These sites are protecting carbon that has been there for millennia. Disturbing them would cause a carbon emission that we wouldn't be able to repair any time soon," says first author Dr Matthew Costa, a coastal ecologist at University of California, San Diego, US.

Costa says that protecting mangroves from disruption would have a significant effect on the climate.

"If we let these forests keep functioning, they can retain the carbon they've sequestered out of our atmosphere, essentially permanently.

"These mangroves have an important role in mitigating climate change."

Cosmos, 20 September 2022

https://cosmosmagazine.com

ALS Risk Higher Among Production Workers, Those Exposed to Metals, Volatile Compounds on Job

2022-09-18

In the 150 years since ALS, or amyotrophic lateral sclerosis, first came to scientific light, there remains no cure for the progressive, fatal neurodegenerative condition. But more research continues to uncover environmental contaminants' insidious role in disease development.

Pesticides and carcinogenic compounds have been found at elevated levels in the blood of patients with ALS, which is also known as Lou Gehrig's disease. And one study works backwards, finding that those

Those working in production occupations, especially those exposed to volatile organic compounds, metals, combustion pollutants, and particulate matter have a higher risk of developing ALS.

working in "production"—fields such as manufacturing, welding and chemical operation—who are exposed to hazardous chemicals on the job, may have increased risk of developing ALS.

A research team at Michigan Medicine surveyed 381 patients with ALS and 272 control participants to analyze self-reported occupational exposures from their four most recent and longest-held jobs.

They found that ALS participants reported higher occupational exposure to metals, particulate matter, volatile organic compounds and combustion pollutants prior to diagnosis. In addition, those working in production occupations had a higher risk of ALS.

Results are published in Interventional Archives of Occupational and Environmental Health.

"This study shows that certain occupational settings and exposures increase one's chances of developing ALS," said first author Stephen Goutman, M.D., M.S., director of the Pranger ALS Clinic and associate director of the ALS Center of Excellence at University of Michigan.

"We have known for some time that certain pollutants can increase ALS risk, but identifying where these exposures are occurring is important as we begin to think about strategies for ALS prevention and studying populations of individuals at high disease risk."

Investigators used a combined approach of patient self-reported occupational exposures and job histories, which were evaluated by exposure scientists. Exposure to metals was most strongly linked to ALS, with iron and welding fume exposure among the most common.

Researchers say this is unsurprising as people in jobs with higher metal exposure, particularly in manufacturing and trade industries, are often exposed to mixtures that may also contain particulate matter, like silica, and volatile organic compounds, such as formaldehyde.

"Some of these workers who later developed ALS may have been exposed to mixtures of metals and other chemicals without their knowledge," Goutman said. "This should lead our research to investigate these mixtures and the resulting injuries to the central nervous system, or what we refer to as the ALS exposome."

It is estimated that almost 10 in 100,000 Americans have ALS, according to the Centers for Disease Control and Prevention. The Midwest has the

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

highest rate of the condition, which often begins with muscle weakness, slurred speech or difficulty swallowing.

The FDA has approved two medications to treat ALS, riluzole and edaravone, both of which have shown minimal effectiveness at slowing disease progression. Patients can also receive non-invasive ventilation, a therapy involving a mask worn over the nose to make breathing easier.

"I have spent my 30-year career on evaluating and treating individuals living with ALS," said senior author Eva Feldman, M.D., Ph.D., director of the ALS Center of Excellence at U-M and James W. Albers Distinguished Professor of Neurology at U-M Medical School.

"ALS remains a disease without an effective treatment. Studies such as ours are critical in identifying modifiable disease factors and populations at risk so that we can prevent ALS from occurring in the first place."

Neuroscience News, 18 September 2022

https://neurosciencenews.com

What constitutes a mind? Researcher challenges perceptions of sentience with the smallest of creatures

2022-09-19

At the beginning of my research career around 15 years ago, any suggestion that a bee, or any invertebrate, had a mind of its own or that it could experience the world in an intricate and multifaceted way would be met with ridicule. As Lars Chittka points out in the opening chapters of "The Mind of a Bee," the attribution of human emotions and experiences was seen as naivety and ignorance; anthropomorphism was a dirty word.

Pet owners eagerly ascribe emotions to their animals, but the simple brain of a bee surely could not experience the rich tapestry that is our existence. They are far too simplistic and robotic, right?

Lars Chittka has been researching honeybees for the past 30 years. "The Mind of a Bee" is a collection of his research stories. It also covers the influential figures in bee research and provides a historical perspective on the research that much behavioral work is built on today.

People have long been curious about the behavior of bees. Many questions posed in the 1800s are still around. While Chittka's beautifully collated and captivating "story" does not present research results that are necessarily new, to read them presented together like this, I find myself

We have underesti-mated the intelligence of bees and other "lower" species for far too long; it is time to pay attention.

tantalized by questions I had not thought to ponder. For example, how do bees decide who stays and who leaves when a swarm is formed?

The world of a bee

The book opens by challenging you to put yourself into the world of a bee.

A honeybee's experience of the world is so completely foreign to our own that to understand and research it is a challenge not to be underestimated. Indeed, it is understandable that we have relegated the experience of bees to something simplistic and robotic when you discover the difficulties faced by researchers.

First, picture yourself as a bee. You have wings, allowing flight. Your vision is not as sharp anymore, worse than your grandfather's with his coke-bottle glasses, but you see things more quickly. Life is experienced on a faster time line—what was once a movie is now more like a series of images in a slideshow.

The antennae protruding from your head function as hands, ears, tongues and noses, all in one. You can tell if someone has visited a flower before you—a flower you picked out of a field of hundreds by its scent, and which you found by following the directions you felt a fellow bee dance for you inside the pitch-black hive perhaps ten kilometers from your current position.

Chittka then invites us to imagine the life of the bee. Upon exiting the hive for the first time, you must learn its location through a series of flights—behavior observed in other central-place foragers such as ants and wasps. Failure to recognize your hive and return home equals death.

Once you have memorized the location of your hive, you then must successfully navigate your way to and from various resource-rich patches as efficiently as possible, learning new locations, the timing of certain flowers releasing their nectar, and the techniques required to manipulate other flowers into relinquishing theirs.

So far, this sounds instinctual, a basic response to hunger. Yet Chittka presents additional research—historical and current—that provides insights into the cognitive skills of bees. We learn that bees can count. They can learn rules and categorize flowers. And they can learn from others, not only which flowers are rewarding, but how to access them.

One of my favorite experiments, perhaps for the videos that accompanied the publication, is of bumblebees pushing balls into holes to get rewards.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

This skill can be learned by an observer bee and, what is truly fascinating, it can be improved upon. The observer bee can solve the task by copying the goal rather than strictly copying the technique, demonstrating an understanding of the task and the desired outcome.

But when would a bee ever need to push a ball into a hole to be rewarded with some "nectar?"

As Chittka rightly points out, the questions we pose to understand the minds of bees must have a biological relevance to make sense. That is, we need to understand what is important to the survival of bees, what is essential in their existence, and frame our questions of intelligence and sentience around that aspect. If we ask the wrong questions, we will never fully understand the answers—like asking a fish to climb a tree and finding it lacking.

Consciousness and emotion

The punch this book packs is in the subtle build-up to the final chapters, whereupon it becomes increasingly hard to deny the "mind" of a bee.

While it is impossible to prove consciousness in another organism, the research Chittka has collated provides a compelling argument. In "The Mind of a Bee," you will read that bees feel emotions and pain, display metacognition (that is, they know what they know), and show individual differences in their ability to learn, with fast and slow learners. Bees are aware of their bodies and the outcomes of their actions, and they display intentionality through tool use—previously only recognized in humans, primates, and the corvidae family of birds.

Regardless of whether you believe a bee has a mind or not, globally there has been a change in research practices as invertebrates are seen to experience the world more fully.

Ethics approval is required for work on some invertebrates, including crustaceans and cephalopods, and statements of ethical treatment of other invertebrates are required for submission of manuscripts to some journals. To suggest an invertebrate, such as a bee, may have these fuller experiences of life is no longer attracting ridicule, but instead is creating an uncomfortable space for insect researchers, who may not wish to confront the reality of their experiments.

We have underestimated the intelligence of bees and other "lower" species for far too long; it is time to pay attention. Chittka shows us that bees have the key ingredients of a mind: they have a representation of space,

they can learn by observation, and they display simple tool use. Bees have demonstrated a flexible memory, with ideas of what they want to achieve, an ability to explore suitable solutions to get it, and an awareness of the possible outcomes of their own actions.

Experiments have further shown that bees appear to attach emotional states to rewards and punishments. While their biology and experience of the world is very different to ours, it is reasonable to believe that they do indeed possess a mind capable of experiencing the rich tapestry of life we have so long thought only available to us.

Written with moments of levity and soaked in curiosity, "The Mind of a Bee" is a delight. While some may not be ready to ascribe sentience to something as "simple" as a bee, this book will prompt you to question why not. As Chittka so eloquently put it in a recent talk: "We are thinking, suffering, enjoying beings in a world of other thinking, suffering and enjoying beings, with different minds and perceptions."

I for one am looking at the world a little differently with that in mind.

Phys Org, 19 September 2022

https://phys.org

Spinal cord regeneration possible in animals

2022-09-21

Scientists have been able to activate specialised proteins involved in the regenerative gene production to help regrow sensory and motor neurons in animal spinal cords after severe injury.

In results published in PLOS Biology, researchers showed that a treatment using a chemical activator called TTK21 can stimulate the regrowth of motor and sensory axons after a spinal cord injury, as well as "synaptic plasticity" which is the development of synapses that connect brain cells to each other to allow communication between them.

"This work shows that a drug called TTK21 that is administered systemically once per week after a chronic spinal cord injury in animals can promote neuronal regrowth and an increase in synapses that are needed for neuronal transmission," said senior author Professor Simone Di Giovanni from University College London.

"This is important because chronic spinal cord injury is a condition without a cure where neuronal regrowth and repair fail."

Promising research into previously incurable injury.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

Severe spinal cord injuries can be caused by a range of factors or events and are characterised by the absence of axon regrowth, connectivity and severe neurological disability. Axons are the cable-like structures through which electrical impulses are sent from one neuron to another.

The TTK21 treatment was given to adult mice three months after receiving a spinal cord injury that destroyed sensory fibres and motor tracts, reducing mobility and emulating severe spinal cord injury.

This molecule has been shown in previous experiments to activate specialised proteins involved in the production of genes that trigger neurone regeneration and enhance memory deficits.

After 10 weeks of treatment, the scientific team observed more axons 'sprouted' in the spinal cords of test mice, and that growth of sensory axons increased above the region where the injury occurred.

Their findings suggest the TTK21 molecule could be used in combination with other therapies to assist with spinal repair and axon growth. They described their findings as demonstrating a "clinically suitable molecular intervention (which) can promote plasticity and growth in both an acute … and chronic spinal cord injury."

"We are now exploring the combination of this drug with strategies that bridge the spinal cord gap, such as biomaterials, as possible avenues to improve disability in SCI patients," says Di Giovanni.

Cosmos, 21 September 2022

https://cosmosmagazine.com

Metabolic study finds night owls more susceptible to diabetes, heart disease

2022-09-20

Researchers from Rutgers University have conducted a close investigation of the metabolic differences between night owls and early birds, finding those who prefer staying up late may be at greater risk of type 2 diabetes and heart disease.

Are you a night person? Maybe you function better in the evenings, and naturally stay up late. Informally you are known as a night owl, someone who gravitates to circadian rhythms slightly out of sync with most people.

Despite the reasons still being unclear, those with a propensity for staying up late should be aware of this increased risk.

Studies have found night owls often display higher rates of diabetes and neurological disorders. A large study tracking half a million people for nearly seven years found night owls had a 10% higher risk of death compared to morning people.

Aside from social and behavioral factors, such as irregular eating or exercise, that can lead to ill health in night owls, researchers have not known whether those with late-night tendencies harbor fundamental metabolic differences to those early morning larks. This new study set out to home in on that particular question by closely investigating 51 volunteers, evenly split between night owls and early birds.

All participants were aged in their mid 50s and lived a relatively sedentary lifestyle. They were all free of any diseases such as diabetes or cancer, however, they were classified as having mild metabolic syndrome. This means they presented with symptoms such as high blood pressure, elevated fasting glucose or increased waist circumference.

The cohort was closely monitored for a week to track physical activity patterns before being called into the lab for a day of metabolic tests. The experiments were designed to measure how the body processes fat and carbohydrates into energy.

The results revealed the morning people were more insulin sensitive and better at using fat for energy compared to the night owls. In contrast, the night people relied more on processing carbohydrates for energy and displayed signs of insulin resistance.

"The differences in fat metabolism between 'early birds' and 'night owls' shows that our body's circadian rhythm (wake/sleep cycle) could affect how our bodies use insulin," said Steven Malin, senior author on the study. "A sensitive or impaired ability to respond to the insulin hormone has major implications for our health."

The researchers conclude these metabolic differences may make night owls more susceptible to cardiovascular disease and type 2 diabetes. However, as with all research, there are some caveats.

The study unfortunately cannot clearly answer whether night owls are intrinsically geared for these metabolic differences. The activity tracking in the week prior to the lab experiments revealed the early birds were more physically active overall compared to the night owls.

So the big lingering question is whether the metabolic differences between the two groups are simply a reflection of differences in physical

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

activity. Or, is physical activity more metabolically beneficial when performed in the morning compared to the night?

"Further research is needed to examine the link between chronotype, exercise and metabolic adaptation to identify whether exercising earlier in the day has greater health benefits," Malin noted.

At the very least, the researchers do indicate the findings affirm night owls likely face higher risk for cardiovascular and metabolic disease. And despite the reasons still being unclear, those with a propensity for staying up late should be aware of this increased risk.

The new study was published in the journal Experimental Physiology.

New Atlas, 20 September 2022

https://newatlas.com

MIT tech could keep items cool without using any electricity

2022-09-20

In some of the world's hottest countries, where cooling systems are most needed, the infrastructure required to power such setups is often lacking. A new system could help in that regard, as it provides multiple cooling effects but uses no electricity.

Building on previous research, the MIT-designed system combines evaporative cooling, radiative cooling, and thermal insulation. It provides up to 19º F (10.5º C) of cooling from the ambient temperature, and takes the form of a panel made up of three layers of different materials.

That panel can be placed over/around an item that needs to be kept cool, such as a box containing perishable goods like food or medication. According to MIT, the technology could "permit safe food storage for about 40% longer under very humid conditions," or "triple the safe storage time under dryer conditions." It could also be used to cool the water utilized in air conditioners, allowing those devices to consume less power while staying just as effective.

The system's bottom layer is a mirror-like material, which reflects incoming sunlight. This keeps the infrared radiation within the sun's rays from heating the covered item. In the middle is a porous hydrogel, composed mostly of water. As that liquid water is heated, it evaporates into vapor which rises to the top layer.

The MIT-designed system combines evaporative cooling, radiative cooling, and thermal insulation.

That top layer is a type of aerogel, made up mostly of air pockets contained within polyethylene cavities. Both the water vapor and the reflected infrared rays are able to pass through the aerogel, providing evaporative and radiative cooling, respectively.

That said, the aerogel also serves as an insulating layer, keeping ambient heat from reaching the item below. Additionally, like the bottom layer, it's also very solar-reflective. Unfortunately, it's currently rather expensive to produce – further research will focus on methods of bringing down the aerogel's production costs.

The other materials used in the system are "readily available and relatively inexpensive." Maintenance would consist solely of adding more water to the hydrogel, which would reportedly only need to be done once every four days in very dry, hot environments, or only once a month in more humid regions.

The research is being led by Zhengmao Lu, Arny Leroy, Jeffrey Grossman, Evelyn Wang, Lenan Zhang and Jatin Patil. It is described in a paper that was recently published in the journal Cell Reports Physical Science.

New Atlas, 20 September 2022

https://newatlas.com

Why crustaceans keep evolving to look like crabs, and how to tell 'true' crabs from 'false' ones

2022-09-18

Few animals are as recognisable as the crab: a rounded, flat body covered in a hard shell, attached to scuttling legs and a pair of pincers.

But not everything that looks like a crab is, technically, a true crab.

Crustaceans have evolved a crab-like body at least five times, resulting in thousands of species of "false crabs".

The process of very distantly related organisms independently developing the same characteristics is known as convergent evolution.

For instance, thylacines had a body that looked very much like that of a dog, but their last common ancestor trotted around 160 million years ago.

"The assumption is that if some creatures look similar, they must be related," said Kareen Schnabel, a marine biologist at New Zealand's

Crustaceans have evolved a crab-like body at least five times, resulting in thousands of species of "false crabs".

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

National Institute of Water and Atmospheric Research who studies false crabs.

"But that just doesn't work for … these more advanced crustaceans."

For crabs, the process is dubbed "carcinisation", a term coined more than a century ago.

So why do crab-like creatures keep turning up on the evolutionary tree, and what makes a true crab truly a crab?

We'll give you some crab-spotting tips, but first, let's wind the clock back a couple hundred million years to the ancestral crab.

When crabs branched out

The last common ancestor of true crabs and their false counterparts lived around 250 million years ago, and may have looked more like a lobster than a typical crab, said Rachael Peart, who also studies crustaceans at New Zealand's National Institute of Water and Atmospheric Research.

Back then, the lineage split into two main groups: one called Brachyura, which are considered true crabs, and Anomura, or what biologists consider false crabs.

But it wasn't until between 145 and 66 million years ago that both groups really stepped up their diversification game, splitting into thousands of new species.

Some researchers suspect the trigger for this "Cretaceous crab revolution" was a concurrent explosion in reef-building coral species.

Assigning current-day "crabs" to true and false groups has not been without its problems, but advances in genetics have helped re-categorise some into their rightful group.

"The king crabs used to be considered true crabs, but they're not," Dr Peart said.

"They're actually closest related to hermit crabs."

How to spot a true crab

You're at the beach, and you spot a crab-looking crustacean waving its claws and scuttling around on the sand. How do you know if it's a true crab or a false one?

1. Look at its legs

Specifically, count the pairs of limbs it uses to get around, also called "walking legs".

True crabs have four pairs of walking legs, while false crabs often have three pairs.

Their fourth pair of legs is still there, but are too short to help them walk.

2. Analyse the antennae

Does the creature have antenna between its eyes and nowhere else? If so, that's another sign of a true crab.

False crabs can have antenna either side of their eyes.

3. Check out its carapace

The hard "lid" covering a true crab's head and upper body — called its carapace — is broad and flat, and typically wider than it is long, Dr Peart said.

"Your blue swimmer crab has a really typical true crab shape."

A true crab's carapace is also completely fused, like a plate. Some false crabs have a carapace that's still somewhat segmented, and looks a bit like path pavers.

"The yeti crabs, which are found in the Australian Southern Ocean, are really quite spectacular and some of them look like true crabs," Dr Peart said.

"But you can see on their carapace there are 'sutures' there, and it's not fused."

4. Take a peek at its tail

If you get to see the crustacean's underside, check out its abdomen, which we tend to think of as its tail.

True crabs flatten and completely tuck their tail under their carapace.

But if you see a fan on the end of the tail, that's a false crab. True crab tails are fan-free.

Why do crab-like features keep appearing?

Exactly why crustaceans keep "crabifying" isn't entirely settled.

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

But some crab qualities have clear benefits. For instance, being flatter lowers an animal's centre of gravity, allowing it to scuttle away faster.

A teeny, tucked-away tail might mean a crustacean can no longer flick it quickly to escape predators, but losing that meaty bulk has an upside, Dr Schnabel said.

"If you can reduce that all down, you can, for example, tuck into smaller crevices in corals or amongst rock."

So is "crabification" inevitable? Are all crustaceans destined to end up looking like crabs?

Nope.

Some true crabs — and even some crab-like false ones — have already evolved to look less like crabs.

For instance, there are true crabs that like to burrow in mud, and they're evolving a longer, more lobster-like body that's more suited to their surroundings, Dr Schnabel said.

"If you're barrel-shaped, you can better retreat into soft sediment and evade predators or be more stealthy."

This "decarcinisation", according to a study published by a trio of US researchers last year, has happened at least seven times.

"Therefore," they write, "the crab-like body plan cannot represent an optimum for all niches, and may be subject to functional trade-offs that allow the evolution (and sometimes persistence) of decarcinisation."

ABC News, 18 September 2022

https://abc.net.au

How Do Rare Earth Elements Form? Scientists Create Synthetic Rocks To Find Out

2022-09-22

New light has been shed on the formation of increasingly precious rare earth elements (REEs) by researchers from Trinity College Dublin. They accomplished this by creating synthetic rocks and testing their responses to varying environmental conditions. REEs are used in many electronic devices and green energy technologies, including everything from smartphones to electric vehicles.

The findings, just published on September 19 in the journal Global Challenges, have implications for recycling REEs from electronic waste, designing materials with advanced functional properties, and even for finding new REE deposits hidden around the globe.

Dr. Juan Diego Rodriguez-Blanco, Associate Professor in Nanomineralogy at Trinity and an iCRAG (SFI Research Centre in Applied Geosciences) Funded Investigator, was the principal investigator of the work. He said:

"As both the global population and the fight against carbon emissions grow in the wake of global climate change, the demand for REEs simultaneously increases, which is why this research is so important. By growing our understanding of REE formation, we hope to pave the way to a more sustainable future.

"The genesis of rare earth deposits is one of the most complex problems in Earth sciences, but our approach is shedding new light on the mechanisms by which rocks containing rare earths form. This knowledge is critical for the energy transition, as rare earths are key manufacturing ingredients in the renewable energy economy."

Rare Earth Artificial Rock Researchers

Many countries are currently searching for more REE deposits with minable concentrations, but the extraction processes are often challenging, and the separation methods are expensive and environmentally aggressive.

One of the main sources of REEs are REE-carbonate deposits. The biggest known deposit is Bayan-Obo in China, which supplies over 60% of the global REEs demand.

What have the researchers discovered?

Their study has revealed that fluids containing REEs replace common limestone – and this happens via complex reactions even at ambient temperature. Some of these reactions are extremely fast, taking place in the same time it takes to brew a cup of coffee.

This knowledge allows the team to better understand the basic mineral reactions that are also involved in industrial separation processes, which will help improve extraction methods and separate REEs from fluids.

The team's research aims to understand the complex processes of REE-carbonate deposit formation. But instead of studying natural samples, they synthesize their own minerals and rare earth carbonate rocks (similar to Bastnasite, the key mineral from which REEs can be extracted from

"As both the global population and the fight against carbon emissions grow in the wake of global climate change, the demand for [Rare Earth Elements] simultaneously increases"

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

carbonatite rocks). They then mimic natural reactions to discover how REE mineralizations form.

This also allows them to assess how changes in the main environmental factors promote their formation. This can help us understand the origin of mineralizations on untapped carbonatite resources, which are not only in China but also in other areas of the world, such as Brazil, Australia, USA, India, Vietnam, South Africa, and Greenland.

"As REEs are playing a critical role in a technology-filled and sustainable future, it is necessary to understand the behavior of REEs in the geochemical cycle and in basic chemical reactions," explains Adrienn Maria Szucs, PhD candidate in Geochemistry in Trinity's School of Natural Sciences, and lead author of this study.

Sci Tech Daily, 22 September 2022

https://scitechdaily.com

New research finds that viruses may have 'eyes and ears' on us

2022-09-23

New UMBC-led research in Frontiers in Microbiology suggests that viruses are using information from their environment to "decide" when to sit tight inside their hosts and when to multiply and burst out, killing the host cell. The work has implications for antiviral drug development.

A virus's ability to sense its environment, including elements produced by its host, adds "another layer of complexity to the viral-host interaction," says Ivan Erill, professor of biological sciences and senior author on the new paper. Right now, viruses are exploiting that ability to their benefit. But in the future, he says, "we could exploit it to their detriment."

Not a coincidence

The new study focused on bacteriophages—viruses that infect bacteria, often referred to simply as "phages." The phages in the study can only infect their hosts when the bacterial cells have special appendages, called pili and flagella, that help the bacteria move and mate. The bacteria produce a protein called CtrA that controls when they generate these appendages. The new paper shows that many appendage-dependent phages have patterns in their DNA where the CtrA protein can attach, called binding sites. A phage having a binding site for a protein produced by its host is unusual, Erill says.

New research suggests that viruses are using information from their environment to "decide" when to sit tight inside their hosts and when to multiply and burst out, killing the host cell.

Even more surprising, Erill and the paper's first author Elia Mascolo, a Ph.D. student in Erill's lab, found through detailed genomic analysis that these binding sites were not unique to a single phage, or even a single group of phages. Many different types of phages had CtrA binding sites—but they all required their hosts to have pili and/or flagella to infect them. It couldn't be a coincidence, they decided.

The ability to monitor CtrA levels "has been invented multiple times throughout evolution by different phages that infect different bacteria," Erill says. When distantly related species demonstrate a similar trait, it's called convergent evolution—and it indicates that the trait is definitely useful.

Timing is everything

Another wrinkle in the story: The first phage in which the research team identified CtrA binding sites infects a particular group of bacteria called Caulobacterales. Caulobacterales are an especially well-studied group of bacteria, because they exist in two forms: a "swarmer" form that swims around freely, and a "stalked" form that attaches to a surface. The swarmers have pili/flagella, and the stalks do not. In these bacteria, CtrA also regulates the cell cycle, determining whether a cell will divide evenly into two more of the same cell type, or divide asymmetrically to produce one swarmer and one stalk cell.

Because the phages can only infect swarmer cells, it's in their best interest only to burst out of their host when there are many swarmer cells available to infect. Generally, Caulobacterales live in nutrient-poor environments, and they are very spread out. "But when they find a good pocket of microhabitat, they become stalked cells and proliferate," Erill says, eventually producing large quantities of swarmer cells.

So, "We hypothesize the phages are monitoring CtrA levels, which go up and down during the life cycle of the cells, to figure out when the swarmer cell is becoming a stalk cell and becoming a factory of swarmers," Erill says, "and at that point, they burst the cell, because there are going to be many swarmers nearby to infect."

Listening in

Unfortunately, the method to prove this hypothesis is labor-intensive and extremely difficult, so that wasn't part of this latest paper—although Erill and colleagues hope to tackle that question in the future. However, the research team sees no other plausible explanation for the proliferation of

CHEMWATCH
Bulletin Board
Curiosities
SEP. 30, 2022

CtrA binding sites on so many different phages, all of which require pili/flagella to infect their hosts. Even more interesting, they note, are the implications for viruses that infect other organisms—even humans.

"Everything that we know about phages, every single evolutionary strategy they have developed, has been shown to translate to viruses that infect plants and animals," he says. "It's almost a given. So if phages are listening in on their hosts, the viruses that affect humans are bound to be doing the same."

There are a few other documented examples of phages monitoring their environment in interesting ways, but none include so many different phages employing the same strategy against so many bacterial hosts.

This new research is the "first broad scope demonstration that phages are listening in on what's going on in the cell, in this case, in terms of cell development," Erill says. But more examples are on the way, he predicts. Already, members of his lab have started looking for receptors for other bacterial regulatory molecules in phages, he says—and they're finding them.

New therapeutic avenues

The key takeaway from this research is that "the virus is using cellular intel to make decisions," Erill says, "and if it's happening in bacteria, it's almost certainly happening in plants and animals, because if it's an evolutionary strategy that makes sense, evolution will discover it and exploit it."

For example, to optimize its strategy for survival and replication, an animal virus might want to know what kind of tissue it is in, or how robust the host's immune response is to its infection. While it might be unsettling to think about all the information viruses could gather and possibly use to make us sicker, these discoveries also open up avenues for new therapies.

"If you are developing an antiviral drug, and you know the virus is listening in on a particular signal, then maybe you can fool the virus," Erill says. That's several steps away, however. For now, "We are just starting to realize how actively viruses have eyes on us—how they are monitoring what's going on around them and making decisions based on that," Erill says. "It's fascinating."

Phys Org, 23 September 2022

https://phys.org

CHEMWATCH

Bulletin Board

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SEP. 30, 2022

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CHEMICAL EFFECTS

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