CHEMWATCH

Bulletin Board

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ASIA PACIFIC

APVMA standards for active constituents for use in agricultural chemical products

2022-03-08

Standards for active constituents for use in agricultural chemical products are published in the Agricultural and Veterinary Chemicals Code (Agricultural Active Constituents) Standards 2022 (the Standards), established under section 6E of the Agricultural and Veterinary Chemicals Code (the Code).

The Standards specify the identity and minimum purity for each active constituent, and where required, also specify the maximum limits for particular impurities of significance for toxicological, environmental, or quality reasons. The Standards assist the Australian Pesticides and Veterinary Medicines Authority (APVMA) in ensuring that proposed active approvals and product registrations will satisfy the safety and efficacy criteria under sections 5A and 5B of the Code. The Standards also assist our Compliance program to ensure approved actives and registered products remain safe and effective and facilitate action taken against non-compliant products and active constituents under sections 83 and 102 of the Code.

Draft standards for proposed new active constituents are consulted on as part of the Gazette notice published for each proposed new active approval, as required under section 12 of the Code.

From time to time existing standards may be revised as part of a chemical review, in response to new information, or to correct errors.

Periodic updates will be made to the Standards and will incorporate standards for new actives consulted on and approved since the previous update, and amended standards. These amendments will be formally consulted on via the APVMA website and/or the Gazette.

Read More

APVMA, 8 March 2022

https://apvma.gov.au/node/97446

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Government to charge KRW 300 deposit per disposable cup starting from June 10 of this year

2022-01-22

From June 10 of this year, the Korean government will implement a deposit system for drinks sold in disposable cups in cafes and fast-food restaurants. Under the plan, people will have to pay a deposit of 300 KRW per disposable cup.

On January 25, the Ministry of Environment (ME, Minister Han Jeong Ae) made a 40-day legislative notice of amendments to the three sub-statutes* in the field of closed-loop recycling, including the Enforcement Decree of the Act on the Promotion of Saving and Recycling of Resources, containing measures mentioned above.

The revision of the aforementioned sub-statutes aims to reduce waste and their recyclability, and the key contents include:

-The implementation of a deposit system for disposable cups.

-Restrictions on the use of polyvinyl chloride (PVC) packaging materials.

-Restrictions on disposable wipes.

-Expansion of paper cartons recycling.

Firstly, the disposable cup deposit system, which will be in effect from June 10 this year, will be imposed onto 38,000 stores nationwide. The plan will be applied to stores with more than 100 branches nationwide. The stores include cafes (Ediya, Starbucks, Twosome Place), confectionery and bakeries (Dunkin', Paris Baguette, Tous Les Jours), fast food restaurants (Lotteria, Mom's Touch, McDonald's, Burger King), ice cream and shaved ice stores (Baskin Robbins, Sulbing), and other beverage stores (Gongcha, Smoothie King, Juicy).

Read More

South Korea Ministry of Environment, 22 January 2022

https://eng.me.go.kr/eng/web/board/read.do?pagerOffset

AMERICA

Is EPA putting interests of chemical companies ahead of your health? These experts think so

2022-03-07

Scientists first discovered the tasteless, odorless chemicals along a stretch of southern New Jersey in 2020. Combinations of carbon and fluorine molecules littered the soil and water, where they were absorbed by fish and, quite possibly, the people who live there.

The compounds are part of a family of thousands of per- and polyfluoroalkyl substances, or PFAS, used for decades in consumer products like Teflon cookware, rain gear, and food packaging. The more scientists research PFAS, the more concern emerges about their potential health effects.

Read More

USA Today, 7 March 2022

https://www.usatoday.com/story/news/2022/03/07/epa-regulation-dangerous-pfas-chemicals-raises-questions-red-flags/9224137002/?gnt-cfr=1

EPA Updates TSCA Inventory

2022-03-07

The U.S. Environmental Protection Agency (EPA) announced on March 4, 2022, the availability of the latest Toxic Substances Control Act (TSCA) Inventory. EPA states that the biannual update to the public TSCA Inventory is part of its regular posting of non-confidential TSCA Inventory data. EPA plans the next regular update of the Inventory for summer 2022. According to EPA, the Inventory contains 86,631 chemicals, of which 42,039 are active in U.S commerce. Other updates include new chemical substance additions, commercial activity data and regulatory flags, such as polymer exemptions, TSCA Section 4 test orders, and TSCA Section 5 significant new use rules (SNUR). EPA notes that on October 15, 2021, it announced a list of 377 specific chemical identities that were expected to lose their confidential status and move to the public portion of the Inventory. According to EPA, these 377 are listed in this public Inventory posting by their specific chemical identities.

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TSCA Blog, 7 March 2022

https://www.tscablog.com/entry/epa-updates-tsca-inventory1

Report: Maryland's Water Pollution Enforcement Is on the Decline

2022-03-10

Maryland's enforcement of water pollution laws has declined over the last two decades, but especially in the last few years, according to a new report.

Environmental groups found that the Maryland Department of the Environment took 422 water pollution enforcement actions between 2016 and 2021 under Gov. Lawrence J. Hogan Jr. (R), which was significantly lower than the 1,280 enforcement actions between 2010 and 2015, during the administration of Gov. Martin J. O'Malley (D).

In the past year alone, MDE took 55% fewer water pollution enforcement actions than the historical average over the last 20 years, according to the report by the Chesapeake Accountability Project, a coalition of environmental groups. The coalition reviewed the Department of the Environment's annual enforcement and compliance reports from 2001 to 2021 "to provide a historical perspective of [water pollution] enforcement in Maryland," said Katlyn Schmitt, a policy analyst for the Center for Progressive Reform.

But the decrease in enforcement actions does not mean that there are fewer pollution violations, and water quality in the Chesapeake Bay remains a concern, the group said.

The environmental groups focused on actions made by the Water and Science Administration within MDE, which is responsible for regulating stormwater from industrial facilities such as processing plants and landfills, from which harmful chemicals can flow into local waterways after it rains. Enforcement action can include penalty fines and referral to the Attorney General for potential litigation.

Read More

Maryland Matters, 10 March 2022

https://www.marylandmatters.org/2022/03/10/report-marylands-water-pollution-enforcement-is-on-the-decline/

EUROPE

Scientific review reveals the chemicals migrating from PET drink bottles

2022-03-08

A systematic evidence map published on March 4, 2022, in the Journal of Hazardous Materials shows that out of 193 chemicals investigated, 150 have been measured to migrate from polyethylene terephthalate (PET, CAS 25038-59-9) bottles into drinks. Spyridoula Gerassimidou of Brunel University, London, and co-authors, including scientists from the Food Packaging Forum, reviewed 91 studies that analyzed migration of chemicals from PET bottles into water, soda, juice, milk, and other drinks. Migration levels were found to vary depending on the geographic location of bottle production, length of storage time, number of reuses, and content. Of the 150 chemicals found in drinks, 18 were measured at levels exceeding EU regulatory limits. These include several phthalates and nickel (Ni, CAS 7440-02-0). Most of the samples exceeding regulatory limits were in fatty foods or food simulants.

Only 41 of the 150 detected chemicals are included in the European Union's regulation on plastic food contact materials (FCMs) "positive list." In addition, 102 out of 150 are included in the Food Packaging Forum's food contact chemicals database (FCCdb) which provides an overview of chemicals intentionally used to produce FCMs. According to Gerassimidou and co-authors, many of the chemicals that migrate from PET, especially those not included on regulatory lists, may be non-intentionally added substances (NIAS), for which risk assessors lack official guidance (FPF reported).

Read More

Food Packaging Forum, 8 March 2022

https://www.foodpackagingforum.org/news/scientific-review-reveals-the-chemicals-migrating-from-pet-drink-bottles

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Eliminating problem plastics

2022-02-24

Plastics play an important role in our daily lives and can often play a critical role, for instance, in protecting food and preventing food waste. But we must take urgent action where the use of plastic is problematic or unnecessary, to stop the issues plastic presents to our environment.

UK Plastics Pact members account for two thirds of all consumer plastic packaging used in the UK and they are strengthening their ambition in the fight against plastic waste. Building on the eight problem plastics identified for elimination in 2019, six new plastic items and materials have been set for elimination.

The key takeaways

• The UK Plastics Pact identify six new problem plastics to be eliminated as far as possible.

• WRAP's ground-breaking research identifies that plastic packaging for uncut fresh fruit and vegetables, should be eliminated unless it is demonstrated to reduce food waste.

• 14 plastic items and materials remain on our investigation list with Pact members committed to developing and implementing solutions to address the issues they present.

The six new problem plastics set for elimination

Items 1-5 in the list should be removed by the end of 2022 as far as possible. Elimination of plastic packaging for uncut fresh fruit and vegetables is a longer-term goal.

1. Plastic wrapping for multi-sales of tins, bottles, and cartons

2. PVC cling film

3. Non-compostable fruit / veg stickers

4. Non-compostable tea and coffee bags

5. Single use, single serving plastic sachets / jiggers in restaurant settings

6. Plastic packaging for uncut fresh fruit & vegetables, unless it is demonstrated to reduce food waste

Read More

WRAP, 24 February 2022

https://wrap.org.uk/resources/report/eliminating-problem-plastics

Belgium rejects 3M appeal and tightens regulations on hazardous chemical

2022-03-08

The discharge standards of the Antwerp plant at the heart of a recent pollution scandal will be tightened despite an appeal by 3M, the company in charge of the factory at the site.

Flemish Environment Minister Zuhal Demir announced on Tuesday that the appeal of multinational 3M against the decision to tighten the discharge standards of their Zwijndrecht plant has been rejected, resulting in the government cracking down on nine types of PFAS, synthetic chemicals dangerous to people's health.

"For companies like 3M, I expect them to fully invest in limiting the present concentrations of hazardous substances to the strict minimum," Demir said.

This will result in the tightening of the relevant discharge standards to 0.1 µg/l with immediate effect, an increase compared to the contested decision.

Taking contested standards further

Amid the ongoing pollution scandal, studies have shown that PFOS (which belongs to the PFAS group) contamination has spread through air, groundwater and soil, and even the far reaches of the region. A recent soil study found the properties of residents of the Zwijndrecht neighbourhood may have to be excavated in order to remove PFOS.

Given the advancing understanding of the serious toxic impact and technical feasibility of removing PFAS from wastewater, the original environmental permit dated September 17, 2020, was updated in October last year to adjust the discharge standards for all dangerous substances between 1µg/l and 20 µg/l, with immediate effect.

Read More

The Brussels Times, 8 March 2022

https://www.brusselstimes.com/belgium/209902/belgium-rejects-3m-appeal-further-tightens-standards-regarding-hazardous-pfas

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European Parliament approves eighth Environment Action Programme

2022-03-11

The European Parliament has formally approved the EU's eighth Environment Action Programme (8EAP), which aims to guide environmental policy to 2030 and align it with the bloc's Green Deal objectives.

Approved with 553 votes in favour, 130 against and seven abstentions, the Parliament confirmed an agreement reached with the Council of Ministers in December on the programme.

Objectives cover circular economy goals, climate change mitigation and adaptation, and a zero-pollution environment, including associated issues of harmful chemicals.

A key part of the programme is the Commission's plans to monitor, assess and report annually on the progress made by the EU and member states in meeting the priority objectives.

The 8EAP "foresees a new summary dashboard and indicators measuring progress 'beyond Gross Domestic Product (GDP)', to guide policymaking".

It will also involve a review of the progress made by 31 March 2024. If this determines that more needs to be done to reach the priority objectives by 2030, the Commission "should table a legislative proposal with additional initiatives", a Parliament press release said.

"EU, national, regional and local authorities must also implement effective, dissuasive and proportionate penalties to reduce the risks of non-compliance with EU environmental law," it added.

Read More

Chemical Watch, 11 March 2022

https://chemicalwatch.com/437671/european-parliament-approves-eighth-environment-action-programme

INTERNATIONAL

‘Greenwashing Is Dangerous’: Lessons for Purpose-Driven Brands from Innocent’s Recent Lashing

2022-03-08

Brands now understand the immense benefits of touting their sustainability and purpose credentials; but those with sustainability ‘halos’ aren’t immune to scrutiny over their claims. As Innocent drinks was recently reminded, the stakes have never been higher for getting it wrong.

Last month, beverage giant Innocent — which, as a startup, had seemed to do no wrong — was pulled up by activist group Plastics Rebellion and the UK’s Advertising Standards Authority on an advert it was deemed overstated the brand’s environmental credentials (see the ad, with Plastics Rebellion commentary, here.

In the ad, animated characters encouraged people to “get fixing up the planet” by buying Innocent drinks. Although the brand hit back that it intended for the ad to be a “call to action,” it failed to address the single-use plastic ‘elephant in the room’ (and the spectre of owner Coca-Cola looming in the background couldn’t have helped).

With brands now understanding how much there is to gain from touting their environmental credentials, the story is a harbinger of other call-outs to come for brands that overclaim the environmental and purpose impacts of their brands and products. So, where do brands go from here? Will public greenwashing ‘trials’ put the brakes on brands’ environmental momentum?

Innocent’s recent PR stoning may well cause other brands to think twice, especially since the smoothie-maker is generally viewed as having excellent sustainability credentials: The brand has committed to a science-based carbon-reduction target and is building a carbon-neutral factory in Rotterdam. The company also looks closely at its supply chain and processes; and in 2018, it became a B Corp. But, even for a brand such as Innocent, the desire to dial-up positive stories comes at a risk. Brands wanting to communicate their environmental impacts to consumers and the media must strike a balance between the stories they tell and the rigour and accuracy that underpins them. And if Innocent had considered more carefully both the overall message of the ad and its environmental credentials, it would have perhaps been a little more reticent.

Read More

Sustainable Brands, 8 March 2022

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https://sustainablebrands.com/read/marketing-and-comms/greenwashing-is-dangerous-lessons-for-purpose-driven-brands-from-innocent-s-recent-lashing

New version of the UP Scorecard features over 70 additional foodware and food packaging products to compare, simpler navigation across menus, and improved customization of containers

2022-03-09

Built upon the first version of the UP Scorecard launched in August 2021, today a new and improved version of the UP Scorecard has been released to the public. The UP Scorecard is an online resource that measures commonly used foodware and food packaging products with a single yardstick to offer companies the first-ever, free, and comprehensive tool for making sustainable purchasing decisions. What’s new in this version? You can now score over 70 additional foodware and food packaging products including cups, plates, trays, bowls, ramekins, takeout containers, lids, utensils, and more. We’ve also strengthened the methodology and improved the user experience, so it’s as easy to use as possible.

Although still in a beta stage (v0.2), this new version has been significantly expanded and improved. A summary of the biggest new features and improvements made include:

• **More use cases and products:** Over 70 additional foodware and food packaging products were added into the tool and can now be assessed. These include cups, plates, trays, bowls, ramekins, takeout containers, lids, and utensils.

• **Customize and compare any product:** Users can now customize individual products including their number of reuses, recycled content, transportation distance from the supplier, recycling and composting eligibility, sourcing certifications, and being free of chemicals of concern. These customized products are now displayed separately on the results page for easier comparison, and a preview of the updated scores is shown directly on the customization page when adjusting a product’s parameters.

Read More

UPS, 9 March 2022

https://upscorecard.org/up-scorecard-version-0-2-released/

Reminder: take part in Defra surveys on Article 33 of UK REACH

2022-03-07

The Department for Environment, Food and Rural Affairs (Defra) invites GB based suppliers and retailers to complete a survey about industry's experience of duties under Article 33 of UK REACH.

These surveys will be live until **14 March 2022**. This is a great opportunity to share your views and experiences on the implementation of Article 33 in Great Britain.

This is not an enforcement challenge. The surveys will help Defra assess suppliers' and retailers' experience of communicating information about SVHCs in articles down the supply chain.

The results will be 100% anonymous and used to inform part of the Secretary of State's review of Article 33.

- **Who should complete the survey:**
  A person from your company who understands the company's processes for communicating information within supply chains.
- **Time to complete:**
  10 minutes (can be completed in multiple sittings)
- **Closing date:**
  14 March 2022

Take the survey

If you are a **retailer**, selling articles directly to the consumer, you can participate in the survey here:

- English retailer survey
- Welsh retailer survey

If you are a **supplier** of articles within the supply chain, you can participate in the survey here:

- English supplier survey
- Welsh supplier survey

If you carry out both roles, you are welcome to participate in both surveys.

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If you have any questions about the survey or the review of Article 33 please contact REACHReviews@Defra.gov.uk.

Defra, 7 March 2022

https://www.gov.uk/

UK REACH authorisation decisions

2022-03-07

The Secretary of State for Defra, with the consent of Scottish and Welsh Ministers, has made decisions on four transitional applications for authorisation for the time-limited use of substances of very high concern (SVHC) under UK REACH.

The Defra Secretary of State has granted authorisation to:

FUJIFILM Diosynth Biotechnologies UK Limited for the following use of 4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated (4-tert-OPnEO):

- Use as a detergent in the purification process of G-CSF (Granulocyte Colony Stimulating Factor) inclusion bodies.

Tata Steel UK Ltd for the following use of chromium trioxide and sodium dichromate:

- Use for Passivation of electrolytic tinplate (ETP)

Tata Steel UK Ltd for the following use of chromium trioxide:

- The use for the manufacture of electrolytic chromium/chromium oxide coated steel (ECCS)

Beckman Coulter UK Ltd for the following uses of:

4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated (4-tert-OPnEO); and

4-nonylphenol, branched and linear, ethoxylated (4-NPnEO)

- Downstream, clinical use of 4-tert-OPnEO and 4-NPnEO-containing laboratory products that require registration, licensing, approval, and monitoring by country-based health authorities. These products are designed for use in dedicated clinical chemistry, immunology, haematology and flow cytometry laboratory instruments and assays (use 3)

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- Downstream, non-clinical use of 4-tert-OPnEO and 4-NPnEO-containing laboratory products designed for use in flow cytometry, genomics and particle characterization laboratory instruments and assays for quality control and research and development (use 4)
- Downstream use of 4-tert-OPnEO-containing laboratory products which are being phased out from the market due to obsolescence or next generation formulations (use 5)

These authorisation decisions were made under Article 127G which relates to a transitional measure of UK REACH. Transitional applications received by the Defra Secretary of State are published on GOV.UK.

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

GOV.UK, 7 March 2022

https://www.gov.uk/government/collections/authorisation-decisions-uk-reach

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Janet's Corner

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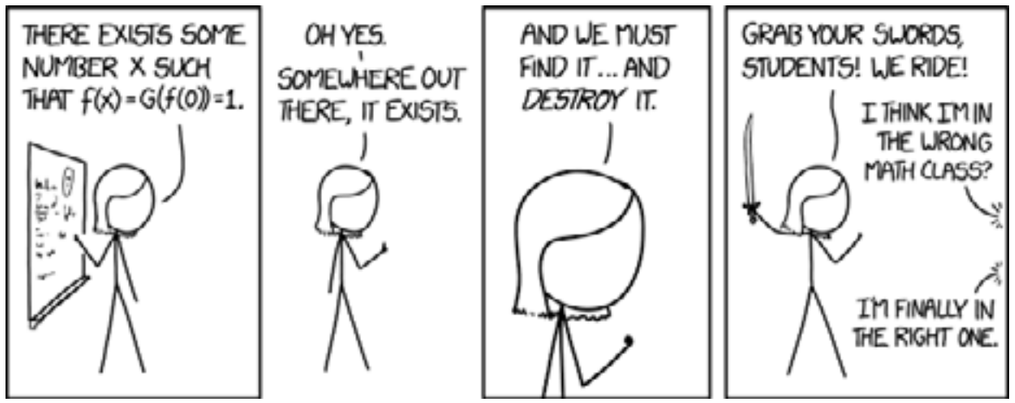
Existence Proof

2022-03-18



https://xkcd.com/1856/

Ammonia

2022-03-18

Ammonia or azane is a compound of nitrogen and hydrogen with the formula NH_3. [1] It is a colourless highly irritating gas with a sharp suffocating odour. Ammonia dissolves easily in water to form ammonium hydroxide solution, which can cause irritation and burns. Ammonia gas is easily compressed and forms a clear, colourless liquid under pressure. It is not highly flammable, but containers of ammonia may explode when exposed to high heat. [2] Ammonia gas can be dissolved in water. This kind of ammonia is called liquid ammonia or aqueous ammonia. Once exposed to open air, liquid ammonia quickly turns into a gas. Ammonia occurs naturally and is produced by human activity. It is an important source of nitrogen, which is needed by plants and animals. Bacteria found in the intestines can produce ammonia. [3]

USES

Ammonia is used widely in many areas. It is present in commonly used household and industrial cleaners, bleaching agents and disinfectants. It is used in the preparation of synthetic fibres (e.g. nylons), plastics and explosives, resins, human and veterinary medicines, fertilisers, chemical compounds, fuel cells, rocket fuel, dyes, metal treating operations, refrigeration, and in the petroleum industry.

SOURCES OF EMISSION [4]

- Industry sources: Ammonia is released during intensive livestock production, and from humans and pets. Other sources of ammonia emission include the manufacture of basic chemicals, metals, leather products, cement, lime, plaster and concrete products, glass products, ceramics, beverages, cars and car parts, textile products and paper and paper products. In addition, ammonia is produced from mining, electricity supply and petroleum refining activities.
- Diffuse sources: Human and pet metabolic processes, cigarette smoke and household cleaners are sources of ammonia. Burning, through controlled fires or wildfires, or of other fuels also results in ammonia emissions. Indoor residential levels of ammonia can be significantly higher than outdoor levels.
- Natural sources: Ammonia is found in the environment, in the air, soil and water, in plants and animals. It is formed naturally by the decomposition of urine and manure. It is a source of nitrogen, which is

Ammonia or azane is a compound of nitrogen and hydrogen with the formula NH3.

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needed by plants and animals. It has also been observed in outer space and galactic dust clouds.

- Transport sources: Motor vehicles, through their exhaust, produce ammonia.
- Consumer products: Many cleaning products, bleaching products and disinfectants contain ammonia.

SOURCES OF EXPOSURE & ROUTES OF EXPOSURE [5]

Sources of Exposure

- Ammonia is found naturally in the environment. The general population is most likely to be exposed through inhalation of contaminated indoor air, although exposure can also occur through ingestion of contaminated food or water, or through dermal contact.
- In indoor air, exposure may occur through use of household products such as window cleaners, floor waxes and smelling salts.
- In outdoor air, exposure may occur as a result of gas leaks and spills at production plants and storage facilities or from pipelines, tank trucks, railcars, ships and barges that transport ammonia.
- Ammonia is released into the atmosphere naturally by decaying organic matter, animal excreta and volcanic eruptions. It is released anthropogenically through fertiliser usage, spills or leaks, and loss from wastewater effluents.
- Farmers, cattle ranchers and individuals who raise livestock and/or poultry may be exposed to ammonia from decaying manure.
- Farmers may also be exposed to ammonia during the application of fertilisers on fields.

Routes of Exposure

- Inhalation – Predominant route of exposure for general population
- Oral – Minor route of exposure for the general population through ingestion of contaminated drinking water.
- Dermal – Minor route of exposure through dermal contact with cleaning products containing ammonia.

HEALTH EFFECTS [4,5]

Exposure to high levels of ammonia can cause irritation and serious burns on the skin, and in the mouth, throat (laryngitis), lungs (pulmonary oedema) and eyes (conjunctivitis). Exposure at very high levels of

ammonia can lead to death. Swallowing concentrated solutions of ammonia can cause burns in the mouth, throat and stomach. Splashing ammonia into the eyes can cause burns and blindness. Individuals that may be more sensitive to ammonia are those with reduced liver function, corneal disease, glaucoma or respiratory diseases (e.g. asthmatics). Ammonia has not been classified for carcinogenic effects by the DHHS, or IARC or EPA.

SAFETY [6]

First Aid Measures

- Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
- Ingestion: If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
- Skin Contact: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
- Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.
- Note to Physician: DO NOT induce emesis, perform gastric lavage or attempt neutralisation after ingestion. Dilution with milk or water may be of benefit. Endoscopic evaluation may be required.

Fire Fighting Measures

- Explosion: Gives off flammable vapours. Vapours may form explosive mixture with air. Closed containers exposed to heat may explode.
- Fire Extinguishing Media: Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire-exposed containers cool. Do not allow water runoff to enter sewers or waterways.
- Special Information: In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full face-piece operated in the pressure demand or other positive pressure mode.

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Exposure Controls & Personal Protection

- Ventilation System: A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area
- Personal Respirators (NIOSH Approved): If the exposure limit is exceeded, a full face piece respirator with an ammonia/methylamine cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.
- WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.
- Skin Protection: Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
- Eye Protection: Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

REGULATION [3,4,6]

Exposure Limits

United States

- The Food and Drug Administration (FDA): Some restrictions have been placed on levels of ammonium salts allowable in processed foods. FDA states that the levels of ammonia and ammonium compounds normally found in food do not pose a health risk.
- The Occupational Safety and Health Administration (OSHA) has set an acceptable eight-hour exposure limit at 25 parts of ammonia per one million parts of air (ppm) and a short-term (15 minutes) exposure level at 35 ppm
- American Conference of Industrial Hygienists (ACGIH): Threshold Limit Value (TLV) 25 ppm (TWA), 35 ppm (STEL).

Australia

- Safe Work Australia: Currently, the eight-hour time weighted average (TWA) exposure limit is 17 milligrams of ammonia per cubic metre of air, and the 15-minute short-term exposure limit (STEL) is 24 milligrams of ammonia per cubic metre of air.
- Drinking water guidelines: In 2004, the National Health and Medical Research Council (NHMRC) and the National Resource Management Ministerial Council (NRMMC) established the following guideline for acceptable water quality: Maximum of 0.5 milligrams per litre of water. This is based on aesthetic consider.

REFERENCES

1. http://en.wikipedia.org/wiki/Ammonia
2. http://www.health.ny.gov/environmental/emergency/chemical_terrorism/ammonia_general.htm
3. http://www.atsdr.cdc.gov/toxfaqs/tfacts126.pdf
4. http://www.npi.gov.au/substances/ammonia/index.html
5. http://www.atsdr.cdc.gov/toxguides/toxguide-126.pdf
6. http://www.chem.tamu.edu/class/majors/msdsfiles/msdsammonia.htm

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DNA Gets Artificial Upgrade to Store Humanity's Boundless Digital Data

2022-03-04

In the last few years, humanity has created more data than in all of history combined -- a remarkable level of output with no signs of slowing down. But where are we going to put all of it?

Though scientists are constantly increasing hard drive sizes to hold humanity's information, and many of them believe this could be done indefinitely, some suggest these efforts will eventually be outrun by the exponential rate at which we generate data. In response to such worries, scientists have been looking into a rather unique solution -- storing files, photos and documents on nature's very own information database: DNA.

DNA is both vast and condensed enough to contain an unfathomable amount of data in hyper small spaces. After all, the double helix strands protect our bodies' entire blueprints while tucked inside cell nuclei merely 10 micrometers wide. Plus, DNA is naturally abundant and can withstand super harsh conditions on Earth. Scientists can even retrieve genetic information from DNA that's several centuries old.

"Every day, several petabytes of data are generated on the internet. Only one gram of DNA would be sufficient to store that data. That's how dense DNA is as a storage medium," Kasra Tabatabaei, a researcher at the Beckman Institute for Advanced Science and Technology, said in a statement.

Tabatabaei is the co-author of a new study, published in last month's edition of the journal Nano Letters, that may well take the DNA data storage concept to great heights. Essentially, the study team is the first to artificially extend the DNA alphabet, which could allow for massive storage capacities and accommodate a pretty extreme level of digital data.

Before we dive into the details, here's a quick biology recap.

DNA encodes genetic information with four molecules called nucleotides. There's adenine, guanine, cytosine and thymine, or A, G, C and T. In a sense, DNA has a four-letter alphabet, and different letter combinations represent different bits of data. With just these four letters, nature can encode the genetic information of every single living organism. So, theoretically, we should be able to store a ton of digital data with this crew of letters, too. But what if we had a longer alphabet? Presumably, that'd give us a much deeper capacity.

Scientists add seven new letters to the existing nucleotide alphabet, opening the door for extreme levels of data storage capacity.

Following this line of thought, the team behind the new study artificially added seven new letters to the DNA repertoire. "Imagine the English alphabet," Tabatabei said. "If you only had four letters to use, you could only create so many words. If you had the full alphabet, you could produce limitless word combinations. That's the same with DNA. Instead of converting zeroes and ones to A, G, C and T, we can convert zeroes and ones to A, G, C, T and the seven new letters in the storage alphabet."

Further, ensuring information encoded in these 11 letters can be regurgitated on demand, the researchers also coined a novel mechanism that precisely reads back the synthetic DNA's data. The system uses deep-learning algorithms and artificial intelligence to discern between the human-made DNA letters and natural ones, as well as differentiate everything from one another.

All in all, it provides an extremely clear readout of the DNA's letter combinations, thereby unveiling any and all information hiding inside.

"We tried 77 different combinations of the 11 nucleotides, and our method was able to differentiate each of them perfectly," Chao Pan, a graduate student at the University of Illinois Urbana-Champaign and a co-author on this study, said in a statement, and "the deep learning framework as part of our method to identify different nucleotides is universal, which enables the generalizability of our approach to many other applications."

DNA isn't the only up and coming, innovative way of holding our compounding data. A Harvard University research team, for instance, is working on using neon dyes to encode invaluable information. Still, Tabatabaei remarked, "DNA is nature's original data storage system. We can use it to store any kind of data: images, video, music -- anything."

CNet, 4 March 2022

https://cnet.com

The closest black hole to Earth is no more — in fact, it never existed

2022-03-04

In 2020, astronomers identified a nearby star system that appeared to contain something phenomenal: the closest black hole to Earth, sitting a mere 1,000 light-years away (that's less than 1% of the width of the Milky Way). Now, new research from some of those same astronomers suggests that they may have been deceived by a cosmic illusion.

Astronomers fell for a cosmic optical illusion — but the truth may be just as cool.

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In a new study published March 2 in the journal Astronomy & Astrophysics, researchers took another look at that star system — named HR 6819 — with the European Southern Observatory's (ESO) Very Large Telescope. What appeared in 2020 to be a system of three massive objects — a large star orbiting a black hole every 40 days, with a second star orbiting much farther away — actually contains no black hole at all, the researchers wrote.

Instead, HR 6819 now appears to be a system of just two stars orbiting each other very closely, and with a very fraught relationship.

"Our best interpretation so far is that we caught this binary system in a moment shortly after one of the stars had sucked the atmosphere off its companion star," study co-author Julia Bodensteiner, an ESO Fellow in Munich, Germany, said in a statement. "This is a common phenomenon in close binary systems, sometimes referred to as stellar vampirism."

As a result, one star lost a tremendous amount of its mass to the other star around the time astronomers observed them in 2020 — making it appear as though the two stars were orbiting each other very far apart, when in fact one star was just much larger than the other, the researchers said. This vampiric mass transfer also would have made the recipient star spin more rapidly, further amplifying the illusion that it was much closer to Earth than its smaller companion star. No black hole required.

Bodensteiner and her colleagues originally proposed this vampire star hypothesis in a June 2020 paper in Astronomy & Astrophysics — one month after the publication of the paper claiming that HR 6819 contained the closest black hole to Earth. In the new paper, Bodensteiner and the authors of the original HR 6819 study joined forces to find out, once and for all, which one of them had the better theory about the strange star system's behavior.

Using several of the Very Large Telescope's high-definition instruments, the researchers found that the two stars in HR 6819 actually orbit one another at only one-third of the distance between Earth and the sun — meaning one of them was much larger and faster-spinning than the other. The vampire star hypothesis won out.

So, while Earth's nearest known black hole may have just been pushed back a few thousand light-years (the next closest one sits about 3,000 light-years away, Live Science previously reported), HR 6819 remains an intriguing study target for other reasons entirely.

"Catching such a post-[vampirism] phase is extremely difficult as it is so short," lead study author Abigail Frost, a postdoctoral researcher at KU Leuven in Belgium, said in the statement. "This makes our findings for HR 6819 very exciting, as it presents a perfect candidate to study how this vampirism affects the evolution of massive stars."

Meanwhile, the search for nearby black holes continues undaunted. According to the study authors, there are tens of millions to hundreds of millions of black holes lurking in the Milky Way alone. It's only a matter of time before astronomers stumble upon another one in our cosmic backyard.

Live Science, 4 March 2022

https://livescience.com

Scientists discover molecule that kills pancreatic cancer cells

2022-03-03

A research team led by scientists at Roswell Park Comprehensive Cancer Center has discovered a molecule that inhibits the growth and metastasis of pancreatic cancer cells through the iron metabolism pathway. Their findings, recently published in Molecular Cancer Therapeutics, pave the way toward the development of a new drug candidate for the treatment of pancreatic cancer.

The molecule, MMRi62, targets iron metabolism to kill cancer cells and the harmful proteins that encourage their growth and spread, suggesting that further development and refinement of this compound could lead to a new type of pancreatic cancer therapy.

"MMRi62 causes degradation of an iron-storage protein called FTH1, as well as a protein that is mutated in PDAC, resulting [in] inhibition of metastasis and ferroptosis, a form of cell death triggered by free cellular iron," says Xinjiang Wang, Ph.D., Associate Professor in the Department of Pharmacology and Therapeutics at Roswell Park.

Pancreatic ductal adenocarcinoma (PDAC) cells are predisposed to ferroptosis, a recently identified type of cell death triggered by iron that has become a focal point of cancer research. The identification of novel agents that activate ferroptosis represents a new area of potential therapies for PDAC, an aggressive and largely incurable disease that accounts for 90% of all types of pancreatic cancer.

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The molecule, MMRi62, targets iron metabolism to kill cancer cells and the harmful proteins that encourage their growth and spread

A unique feature of PDAC are mutations in the KRAS and TP53 genes, which drive the disease and make tumors resistant to chemotherapy. Because drugs and treatments targeting these mutations are not yet available, therapeutic options for patients with PDAC are limited, and the disease has a 5-year survival rate of only 12%.

"We showed through this study that in a preclinical model, MMRi62 is capable of inducing ferroptosis in PDAC cells harboring either KRAS or TP53 mutations, which in turn inhibited tumor growth and prevented metastasis of tumors to distant organs," adds Dr. Wang.

"Although no ferroptosis-inducing agents are currently available, our hope is that our discovery will lead to promising new MMRi62-based treatments for recalcitrant cancers such as PDAC."

Medical Xpress, 3 March 2022

https://medicalxpress.com

For LGBQ scientists, being out can mean more publications

2022-03-02

Papers are a key currency for academic careers—which is why publication disparities among various groups, such as men versus women, are often a focal point for efforts to increase equity and diversity. Now, a new study quantifies another of these gaps: LGBQ academic scientists who don't disclose their sexual orientation in the workplace publish fewer papers than their out or non-LGBQ peers.

It isn't clear whether the act of disclosure itself frees LGBQ scientists to publish more. Another possibility is that the results reflect workplace culture; a safe, welcoming environment that encourages disclosure may also foster productivity. But regardless of the direct cause, "It shows that we've got substantial climate issues," says Kristen Renn, an associate dean at Michigan State University who studies LGBTQ issues in higher education and was not involved in the study.

The good news, though, is that if you are in a place where you feel safe and supported, being open about your identity is best for your career, says Bryce Hughes, an assistant professor at Montana State University whose research indicates that undergraduate students who are LGBQ have lower retention in science, technology, engineering, and math (STEM). "It should feel encouraging that the research is showing if you don't hide it—if you're

New study highlights the disparity and related workplace culture issues

able to be out and be comfortable—you'll be more productive," says Hughes, who was not involved in the study.

According to the paper, published today in PLOS ONE, openly gay and bisexual men published the most among LGBTQ respondents, reporting publication records that were roughly equivalent to that of straight men. LGBQ scientists who didn't share their sexual orientation with their colleagues, on the other hand, published the least. Nondisclosing LGBQ women fared the worst, publishing 14 fewer papers in the first 20 years of their publishing career compared with straight men—pointing to a "double whammy of sexism and homophobia," Renn says. The researchers didn't find evidence of a similar effect of outness for gender minority scientists, but the number of nonbinary and transgender survey respondents was low—just 212 out of the total 1745 respondents, whereas 1093 identified as a sexual minority.

Publication counts aren't necessarily an ideal metric of productivity, acknowledges study author Jeremy Yoder, an assistant professor at California State University, Northridge. "But it is tied to everything from hiring to grant funding to awards and recognition," he says. "So if you are struggling to publish for whatever reason, that's going to be linked to challenges in basically every aspect of advancement in academic science. And those things are going to play into people's decisions whether or not to remain in the field."

But the results don't necessarily mean that all LGBTQ scientists who are out fare better than their less open peers, notes Anna Dye, a Ph.D. student at North Carolina State University who works on LGBTQ policy initiatives through the U.S. National Science Policy Network and the UK Science and Innovation Network. "The people we aren't hearing from are those that disclosed their identity and then subsequently left science," she says. "There may be a selection bias for people who are out and that have supportive environments that helped them to thrive and continue in academia."

It's important for scientists to find those supportive environments because it's stressful to be in the closet at work, Dye says. "If you aren't able to share who your partner is, then that basically takes out most of your personal life that you can share with your co-workers. And that can create a lot of sense of isolation, and also fear of being outed." It's particularly tricky for early career researchers and those who live in locations without strong antidiscrimination laws, she adds, because they may feel a greater risk of being out.

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"Not feeling like you could get to know your colleagues that closely could hinder academic progress," Hughes adds. "Getting to know each other on a personal basis establishes some level of trust. They think of you when opportunities come up. They think of you when doing introductions."

Faculty members who are open about their LGBTQ identity can serve as valuable role models for younger scientists who aren't sure about coming out, Dye says. But that can only happen if universities create an environment that fosters disclosure—for example, by providing all gender restrooms, implementing inclusive name change policies, and facilitating opportunities for LGBTQ scientists to network with one another. Safe space certification, which provides academics with a sticker they can display in their office or lab to indicate they've undergone training in how to talk about LGBTQ issues, is also a good tool, Yoder adds.

Taking such steps may be important not only for individual researchers, but also for the future of STEM, Hughes says. "There probably is science that isn't being done because of the climate that people are navigating."

Science, 2 March 2022

https://science.org

Meta-analysis of 15 studies reports new findings on how many daily walking steps needed for longevity benefit

2022-03-03

The analysis represents an effort to develop an evidence-based public health message about the benefits of physical activity. The oft-repeated 10,000-steps-a-day mantra grew out of a decades-old marketing campaign for a Japanese pedometer, with no science to back up the impact on health.

Led by University of Massachusetts Amherst physical activity epidemiologist Amanda Paluch, an international group of scientists who formed the Steps for Health Collaborative found that taking more steps a day helps lower the risk of premature death. The findings are reported in a paper published March 2 in Lancet Public Health.

More specifically, for adults 60 and older, the risk of premature death leveled off at about 6,000-8,000 steps per day, meaning that more steps than that provided no additional benefit for longevity. Adults younger

Interestingly, the research found no definitive association with walking speed, beyond the total number of steps per day.

than 60 saw the risk of premature death stabilize at about 8,000-10,000 steps per day.

"So, what we saw was this incremental reduction in risk as steps increase, until it levels off," Paluch says. "And the leveling occurred at different step values for older versus younger adults."

Interestingly, the research found no definitive association with walking speed, beyond the total number of steps per day, Paluch notes. Getting in your steps -- regardless of the pace at which you walked them -- was the link to a lower risk of death.

The new research supports and expands findings from another study led by Paluch, published last September in JAMA Network Open, which found that walking at least 7,000 steps a day reduced middle-aged people's risk of premature death.

The Physical Activity Guidelines for Americans, updated in 2018, recommends adults get at least 150 minutes of moderate-intensity aerobic physical activity each week. Paluch is among the researchers seeking to help establish the evidence base to guide recommendations for simple, accessible physical activity, such as walking.

"Steps are very simple to track, and there is a rapid growth of fitness tracking devices," Paluch says. "It's such a clear communication tool for public health messaging."

The research group combined the evidence from 15 studies that investigated the effect of daily steps on all-cause mortality among adults age 18 and older. They grouped the nearly 50,000 participants into four comparative groups according to average steps per day. The lowest step group averaged 3,500 steps; the second, 5,800; the third, 7,800; and the fourth, 10,900 steps per day.

Among the three higher active groups who got more steps a day, there was a 40-53% lower risk of death, compared to the lowest quartile group who walked fewer steps, according to the meta-analysis.

"The major takeaway is there's a lot of evidence suggesting that moving even a little more is beneficial, particularly for those who are doing very little activity," Paluch says. "More steps per day are better for your health.

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And the benefit in terms of mortality risk levels off around 6,000 to 8,000 for older adults and 8,000 to 10,000 for younger adults."

Science Daily, 3 March 2022

https://sciencedaily.com

Cellular rejuvenation therapy safely reverses signs of aging in mice

2022-03-07

Age may be just a number, but it's a number that often carries unwanted side effects, from brittle bones and weaker muscles to increased risks of cardiovascular disease and cancer. Now, scientists at the Salk Institute, in collaboration with Genentech, a member of the Roche group, have shown that they can safely and effectively reverse the aging process in middle-aged and elderly mice by partially resetting their cells to more youthful states.

"We are elated that we can use this approach across the life span to slow down aging in normal animals. The technique is both safe and effective in mice," says co-corresponding author Juan Carlos Izpisua Belmonte, professor in Salk's Gene Expression Laboratory and holder of the Roger Guillemin Chair. "In addition to tackling age-related diseases, this approach may provide the biomedical community with a new tool to restore tissue and organismal health by improving cell function and resilience in different disease situations, such as neurodegenerative diseases."

"We are elated that we can use this approach across the life span to slow down aging in normal animals[''].

As organisms age, it is not just their outward appearances and health that change; every cell in their bodies carries a molecular clock that records the passage of time. Cells isolated from older people or animals have different patterns of chemicals along their DNA—called epigenetic markers—compared to younger people or animals. Scientists know that adding a mixture of four reprogramming molecules—Oct4, Sox2, Klf4 and cMyc, also known as "Yamanaka factors"—to cells can reset these epigenetic marks to their original patterns. This approach is how researchers can dial back adult cells, developmentally speaking, into stem cells.

In 2016, Izpisua Belmonte's lab reported for the first time that they could use the Yamanaka factors to counter the signs of aging and increase life span in mice with a premature aging disease. More recently, the team found that, even in young mice, the Yamanaka factors can accelerate muscle regeneration. Following these initial observations, other scientists

have used the same approach to improve the function of other tissues like the heart, brain and optic nerve, which is involved in vision.

In the new study, Izpisua Belmonte and his colleagues tested variations of the cellular rejuvenation approach in healthy animals as they aged. One group of mice received regular doses of the Yamanaka factors from the time they were 15 months old until 22 months, approximately equivalent to age 50 through 70 in humans. Another group was treated from 12 through 22 months, approximately age 35 to 70 in humans. And a third group was treated for just one month at age 25 months, similar to age 80 in humans.

"What we really wanted to establish was that using this approach for a longer time span is safe," says Pradeep Reddy, a Salk staff scientist and co-first author of the new paper. "Indeed, we did not see any negative effects on the health, behavior or body weight of these animals."

Compared to control animals, there were no blood cell alterations or neurological changes in the mice that had received the Yamanaka factors. Moreover, the team found no cancers in any of the groups of animals.

When the researchers looked at normal signs of aging in the animals that had undergone the treatment, they found that the mice, in many ways, resembled younger animals. In both the kidneys and skin, the epigenetics of treated animals more closely resembled epigenetic patterns seen in younger animals. When injured, the skin cells of treated animals had a greater ability to proliferate and were less likely to form permanent scars—older animals usually show less skin cell proliferation and more scarring. Moreover, metabolic molecules in the blood of treated animals did not show normal age-related changes.

This youthfulness was observed in the animals treated for seven or 10 months with the Yamanaka factors, but not the animals treated for just one month. What's more, when the treated animals were analyzed midway through their treatment, the effects were not yet as evident. This suggests that the treatment is not simply pausing aging, but actively turning it backwards—although more research is needed to differentiate between the two.

The team is now planning future research to analyze how specific molecules and genes are changed by long-term treatment with the Yamanaka factors. They are also developing new ways of delivering the factors.

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"At the end of the day, we want to bring resilience and function back to older cells so that they are more resistant to stress, injury and disease," says Reddy. "This study shows that, at least in mice, there's a path forward to achieving that."

Belmonte is currently an Institute Director at Altos Labs, Inc., in addition to being a professor at the Salk Institute.

Other authors included Mako Yamamoto, Isabel Guillen Guillen, Sanjeeb Sahu, Chao Wang, Yosu Luque, Javier Prieto, Lei Shi, Kensaku Shojima, Tomoaki Hishida and Concepcion Rodriguez Esteban of Salk; Kristen Browder, Zijuan Lai, Qingling Li, Feroza Choudhury, Weng Wong, Yuxin Liang, Dewakar Sangaraju, Wendy Sandoval, Michal Pawlak, Jason Vander Heiden and Heinrich Jasper of Genentech, Inc.; Amin Haghani and Steve Horvath of UCLA; Estrella Nuñez Delicado of Universidad Católica San Antonio de Murcia; and Pedro Guillen Garcia of Clínica CEMTRO.

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Salk Institute, 7 March 2022

https://salk.edu

Chemical Recycling of Plastics is 'False Solution,' Scientists Suggest

2022-03-10

After research involving eight plants in the United States, the Natural Resources Defense Council (NRDC) has found that advanced recycling touted by industry groups, also known as chemical recycling, is in fact a 'false solution,' Agence France Press (AFP) reported.

Chemical recycling differs from the world's most used mechanical recycling which doesn't contribute to producing high quality plastics. Chemical recycling uses different techniques (high temperature, chemical reactions…) that help break plastic down to its molecular building blocks.

The NRDC believes the plants using this technique are very far from producing new plastic.

The council, which rejects "greenwashing" (misleading consumers on the environmental performance of companies or products), noted that these plants are in fact producing fuel that would be burned later, in addition to huge amounts of waste.

"Chemical recycling plants are not only failing to recycle plastic in an efficient and safe way, but they are also emitting polluting substances to the atmosphere"

"Chemical recycling plants are not only failing to recycle plastic in an efficient and safe way, but they are also emitting polluting substances to the atmosphere," said Veena Singla, a senior scientist at the NRDC who authored the research.

The NRDC also found "five of the eight studied facilities were producing fuel and burning it directly to generate electricity. This process emitted greenhouse gasses highly responsible for climate change.

Six of these plants are allowed to produce PAHs (polycyclic aromatic hydrocarbons), chemical materials resulting from chemical recycling and causing health problems. According to the report, producing fuel from plastic waste does not qualify as recycling.

The Natural Resources Defense Council studied a factory in Oregon that produces polystyrene and uses pyrolysis technology to convert this material into styrene. The council notes that between 2018 and 2020, the Agilex plant sent a total of 150 kilograms of styrene to "burn it instead of converting it into new plastics."

In 2019, about 230,000 kilograms of hazardous waste (gasoline, lead and cadmium…) were also transported to other sites for incineration.

Asharq Al-Awsat, 10 March 2022

https://english.aawsat.com

Fears for bees as US set to extend use of toxic pesticides that paralyse insects

2022-03-08

The US Environmental Protection Agency is poised to allow the use of four of the most devastating chemicals to bees, butterflies and other insects to continue in America for the next 15 years, despite moves by the European Union to ban the use of toxins that have been blamed for widespread insect declines.

The EPA is widely expected to confirm a proposed plan outlined last year that will extend the use of imidacloprid, thiamethoxam, clothianidin and dinotefuran on US farmland for the next 15 years, even though the agency has noted "ecological risks of concern, particularly to pollinators and aquatic invertebrates".

These four insecticides are all types of neonicotinoids, a class of chemicals that is widely used on crops to treat them for pests but has been found to

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EPA to approve plan for four types of neo-nicotinoid chemical to be used on US farm-land – despite being banned in Europe

cause devastation among non-target insects, such as bees. The chemicals assault receptors in an insect's nerve synapse, causing uncontrollable shaking, paralysis and death.

Neonicotinoids are used across 150m acres of American cropland, an area roughly the size of Texas, and have contributed to the land becoming 48 times more toxic than it was a quarter of a century ago. The chemicals are water soluble and quickly leach out of plants into soils and streams, causing such harmful impacts to wildlife that Canada has restricted their use while the EU has banned the outdoor deployment of clothianidin, imidacloprid and thiamethoxam.

But while states such as Connecticut and New Jersey have enacted some curbs on neonicotinoids, the US federal government is set to bend to pressure from farming groups and pesticide makers to perpetuate their use nationally.

"We are already seeing crashes in insect numbers and we don't have another 15 years to waste," said Nathan Donley, environmental health science director at the Center for Biological Diversity.

"It's frustrating to see the EPA go down this path. We really are at a crossroads – we can follow the science and the rest of the world or we can go out on our own and appease the chemical industry."

An EPA spokeswoman said that review decisions for the neonicotinoids will be issued in "late 2022" and that mitigation rules for their use are being considered. "We understand the importance of pollinators for healthy ecosystems and a sustainable food supply," she said, adding that the EPA "is working aggressively to protect pollinators, including bees".

An outright ban, similar to the EU, appears unlikely for the US, however. "While the agency reviews the regulatory efforts of the EU, EPA also looks at regulation in countries such as Australia, Canada, Japan, New Zealand, and others that share our risk-based approach to regulation," said the spokeswoman. "The differences in the details of our underlying laws can naturally lead to different regulatory conclusions."

The use of neonicotinoids, hailed by industry as a key to bumper crop yields, has exploded since the 1990s. The chemicals are sprayed directly on to fruit and vegetables but are most commonly found embedded in the coating of corn and soybean seeds sold by companies such as Bayer and Syngenta to farmers.

Only a small fraction of the insecticide stays within the growing plant, however, instead seeping into pollen, water and soils where insects are exposed to it. Researchers have found that the cognitive functions of bees are scrambled by the chemicals, making them unable to find their way to their hives, while affected beetles stagger around as if drunk.

Neonicotinoids also harm birds, studies have shown, while their benefits are questionable, with crop yields in many cases not improved by the indiscriminate use of the chemicals.

"These insecticides are not helping the productivity of crops on fields – it seems an amazing effort to blanket all these acres with something that doesn't have a return on investment," said John Tooker, an entomologist at Penn State University.

"These seeds are marketed so well to farmers that they become scared they will have a catastrophic outbreak of pests if they don't use them, even though this is unlikely. It has contributed to this toxic landscape across the country."

The application of pesticides, along with habitat loss and climate change, has been cited as the main causes of spectacular insect declines recorded in the US as well as several European countries. Worldwide, it is estimated that insect populations are dropping by as much as 2% a year, with the United Nations warning that half a million species could be wiped out this century.

Tooker said that neonicotinoids, if used judiciously, can be useful but that their ubiquity has contributed to insects' woes. "It's difficult to dismiss the increasing toxicity in the landscape and think it's doing nothing to insect populations," he said. "These are the most powerful insecticides ever produced. We are just making insects' lives harder in every possible way."

Environmental groups, meanwhile, have launched a legal effort to force the EPA to regulate neonicotinoid-coated seeds and have urged the agency to reduce the number of "emergency" permits issued to states that request the spraying of the chemicals beyond what is normally allowed without a full review process.

The EPA is considering allowing farmers in Florida to spray clothianidin on 125,000 acres of citrus crops, including oranges, grapefruits and lemon, which would be the ninth consecutive year such an emergency request has been granted.

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"It defies all logic to say an emergency has been going on for nine years, the process has been clearly abused," Donley said. "The science is so conclusive that these chemicals are harmful to the environment that this emergency exemption process is being used as a backdoor approval that goes on forever.

"We need an administration that is willing to think about reform and challenge the status quo and we haven't seen that with the Biden administration. It is certainly better than Trump but there is a lot of disappointment at the lost opportunity for change."

The Guardian, 8 March 2022

https://theguardian.com

Weird world of high-pressure chemistry made simple by new electronegativity scale

2022-03-07

A Skoltech professor and his Chinese colleagues have revised a key chemical concept, electronegativity, and determined this characteristic for all elements under varying pressures. The revamped notion of electronegativity provides a unified theoretical framework for understanding the numerous anomalies of high-pressure chemistry. The study came out in the Proceedings of the National Academy of Sciences journal.

Electronegativity and the closely related notion of chemical hardness are two fundamental properties of chemical elements that largely determine what they react with and how. "Drop a piece of copper into a glass of water, and nothing much happens. Yet if you drop a piece of sodium into water, a violent chemical reaction ensues, generating enough heat to melt the sodium. The reason for this is sodium's exceptionally low electronegativity: It is very eager to give up its electrons in favor of other atoms," study co-author Skoltech Professor Artem R. Oganov comments.

Electronegativity is arguably the most important characteristic of a chemical element. Depending on whether it is low or high, it reflects the atom's tendency to yield or capture electrons in chemical reactions. This property has meaning when seen in comparison: The more different it is for two arbitrary elements, the more vigorously their atoms react. This makes the electronegativity champion fluorine and anti-champion cesium two of the most reactive elements. They are so eager to react that none of them is ever found in nature in its pure form.

"We know an awful lot about how substances behave under atmospheric pressure, but come to think of it, this is not a typical situation at all,"

The elements' electronegativities give one a very reasonable idea not just of what reacts with what, but which type of a chemical bond will form and which properties the resulting compound will have. However, all of this only applies to chemistry under standard conditions.

"We know an awful lot about how substances behave under atmospheric pressure, but come to think of it, this is not a typical situation at all," Oganov points out. "Most of the Earth's matter and that of other planets exists under enormous pressures—almost 4 million atmospheres at the center of the Earth, for example."

Once researchers found ways to recreate such pressures in the lab (e.g., using diamond anvil cells) and model them on the computer (e.g., using USPEX, Oganov's method for predicting crystal structures), exotic phenomena that run counter to classical chemistry rules started cropping up one after another.

Namely, it turned out that at sufficiently high pressures:

- Every substance becomes a metal. Interestingly, the metal sodium first turns dielectric, at 2 million atmospheres, before metallizing again for good under even greater compression.
- The inert gases are no longer inert and do form compounds. Even helium.
- Potassium and some other elements give rise to strange nonperiodic structures, where some atoms form a framework and others assemble into chains running through channels in the framework. The periodicity of the framework and of the chains differs, and the overall structure therefore has no repeated unit cell.
- Many elements become electrides. That means they banish electrons into the lattice voids, endowing the crystal with peculiar properties.
- Any two elements, even the seemingly boring sodium and chlorine in table salt (NaCl), form uncanny compounds governed by mysterious rules: Na3Cl, NaCl7, etc. Incidentally, among such anomalous substances are the record-breaking high-temperature superconductors H3S, LaH10, YH6, etc.
- Unusually high valences are observed. Cesium and copper, for example, attain the valences of five and four, respectively.
- Copper and boron, magnesium and iron, and other combinations of elements that never react at atmospheric pressure do form compounds.

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Oganov and his colleagues managed to explain these bizarre phenomena by revising the fundamental chemical notions of electronegativity and chemical hardness. The researchers recognized that the definition of electronegativity introduced in 1934 by Robert Mulliken was inapplicable under extremely high pressure. The team modified the definition and measured the electronegativity—and chemical hardness—for every element in the periodic table up to No. 96 in the pressure range from zero to 5 million atmospheres.

"These two parameters largely determine the chemical properties of atoms, and we set out to investigate how they vary as pressure grows. Since compression affects the electron configuration of an atom, it is only natural to expect its electronegativity to change accordingly," Oganov says.

Mulliken electronegativity is computed from the ionization energy of an atom and its electron affinity energy. The former is a measure of how difficult it is to rip an electron from the atom, the latter reflects to what extent the atom is "willing" to grab an electron from the surrounding vacuum. Half the sum of these two values yields electronegativity, and half the difference between them is the element's chemical hardness. Under standard conditions, they are very similar because electron affinity tends to be very small. As a result, chemical hardness tends to be neglected. Things become different, though, once you step up the pressure.

"Under high pressures, these two parameters diverge and have different physical meanings. For a solid material, chemical hardness is the bandgap, which controls whether the material is a metal, a dielectric, or a semiconductor," Oganov explains. "As for electronegativity, its meaning is the electron's chemical potential in the atom—that is, the Fermi energy in the case of a solid. There are two caveats to calculating that value under pressure. First, pressure means no vacuum, so the standard definition with its reference to the potential of an atom's ionization and affinity toward vacuum electrons is inapplicable. Hence, in our definition, the atom exchanges electrons with the electron gas, not vacuum. Second, we replace ionization and affinity energies with enthalpies, which is essential for generating meaningful predictions under pressure."

In establishing the electronegativity of all elements under pressure, the team faced challenges that went beyond theoretical intricacies. Oganov recalls one of the experimental difficulties: "Mulliken electronegativity is a property of an isolated atom in the vacuum, yet how do you put an atom under enormous pressure while still keeping it essentially isolated from outside influences? There is, however, a trick—we confined it in a cell of

helium atoms, which are, well, as inert as it gets. Also, helium atoms are small, so the pressure is evenly distributed."

Under helium pressure, the researchers measured the energy—or rather, enthalpy—of electron separation from and accession to the atom, using these data to compute electronegativity and chemical hardness. "This work was done on and off and took us almost seven years," Oganov remembers. "As we began, Xiao Dong, the first author, was still a Ph.D. student at my lab. By the time we were done, he was a professor. The study involved more than just hard thinking, it required a lot of exacting calculations—but this was all worth it." The new scale of electronegativity and chemical hardness turned out to successfully account for the heretofore unexplained amazing phenomena of nonclassical chemistry.

Since the electron reservoir under the new definition is the electron gas, it follows that an atom whose electronegativity is negative will surrender electrons to the gas. Otherwise, it either captures electrons, in the case of positive electronegativity, or remains in equilibrium with the gas, if the value is zero. The electronegativities of most metals came out at close to zero, which justifies the use of the familiar electron gas model to describe metals.

Under increasing pressure, chemical hardness tends to decline. This translates into shrinking bandgaps and pushes every element to eventually become a metal.

Electronegativities, too, have the tendency to drop under pressure, meaning that the atoms become more willing to lose electrons. As the atom gets compressed, less space remains available for the electrons. At some point, they have nowhere to go and are banished into the lattice voids. This gives rise to electrides.

Calcium, barium, strontium, potassium, and sodium attain such low values of chemical hardness under pressure that their crystals undergo so-called disproportionation into atoms with distinct roles in the lattice, leading to the formation of weird nonperiodic crystal structures made up of a primary framework and secondary chains within it.

Even under extreme pressure, fluorine remains the uncontested champion in electronegativity. As for the most electropositive atom, remarkably, cesium is surpassed by sodium. "And at some point magnesium, too, when the pressure is high enough, which is a violation of the periodic law, because magnesium comes from another group in the periodic table," Oganov comments on the results, adding that the immense

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electropositivity of sodium and magnesium under pressure makes them incredibly reactive.

In nickel, palladium, and platinum, the two topmost electron shells rearrange themselves in a way that creates a complete d-electron shell. Since complete shells are highly stable, these elements become more inert and cease to react with some of the atoms they normally form compounds with.

This same effect is of even more consequence for the elements in the neighboring groups that are suddenly just one or two electrons short of a complete shell—cobalt, iron, rhodium, ruthenium, osmium, iridium—making them almost as electronegative as iodine and tellurium. Conversely, their counterparts whom the rearrangement leaves with one or two "excess" electrons—copper, silver, zinc, cadmium—become very electropositive, or rejecting toward electrons.

The difference in electronegativity between magnesium and iron under pressure gets as high as four times what it is under normal conditions. Copper and boron behave similarly. This leads to reactions between these normally nonreacting elements.

"We did lots of tests," Oganov says. "And we can confirm that copper indeed readily reacts with boron and other elements. And cobalt and rhodium easily take away the electrons of many metals. We believe this might prove very important for geochemistry, affecting the behavior and fate of many elements in the interior of planets."

"Another one of our observations: As chemical hardness drops, so does the degree of electron localization on bonds, resulting in so-called multicenter bonds. In fact, this is how exotic compounds such as $NaCl_7$ emerge," the first author of the paper, Professor Xiao Dong of Nankai University, adds.

"Lastly, while it is still true that an atom will give up each successive electron less readily than the previous one, the lower electronegativity and chemical hardness values under pressure lead to this effect being somewhat less pronounced. This enables the existence of cesium with a valence of five, copper with a valence of four, and so on. So these eccentricities, too, follow from our revamped electronegativity scale," Dong concludes.

By revising two central concepts of chemistry, the authors of the study have managed to explain a host of puzzling phenomena in terms of

a unified theoretical approach and generate new hypotheses with implications for geology, planetology, and other sciences.

Phys Org, 7 March 2022

https://phys.org

Skin whitening creams containing high levels of mercury continue to be sold on the world's biggest e-commerce sites, new report finds

2022-03-09

Skin whitening products containing high levels of mercury continue to be sold on the world's biggest e-commerce platforms, including websites run by eBay, Amazon and Alibaba, a new report by the Zero Mercury Working Group (ZMWG) finds.

The report, shared exclusively with CNN ahead of publishing, is the third by the ZMWG to reveal high levels of mercury in, and the global availability of, skin whitening soaps and creams. This is, however, the group's first report to focus solely on the online sale of these products.

For its research, ZMWG purchased and tested 271 skin lightening products from more than 40 e-commerce sites in 17 countries across Europe, Asia, Africa and the Americas. Of these, 129 products in 16 countries were found to have high levels of mercury and were being sold on more than 30 different sites.

"When we started looking at these products online, there was such widespread use," said Michael Bender, Executive Director of the Mercury Policy Project and a coordinator for ZMWG. "It was like an explosion compared to what we were seeing in the local markets," he told CNN.

The use of mercury in cosmetics is restricted in most countries due to its toxic effects. In 2013, the Minamata convention on mercury set an international limit for cosmetics of 1mg/kg of mercury, or 1 part per million (ppm) which came into force in 2021, though this excludes eye area cosmetics. The manufacture, import and export of cosmetics with over 1 ppm mercury is also prohibited under the global treaty.

But 47% of the skin whitening products tested by the ZMWG contained more than the permitted level of mercury, with many containing over 10,000 ppm of mercury -- and some over 50,000ppm, according to the report. CNN did not independently test the products named in the report.

Some skin whitening products sold online have thousands of times the level of mercury considered safe

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The ZMWG, an international coalition of more than 110 public interest, environmental and health NGOs from over 55 countries, is calling for online e-commerce sites to be made liable for products sold on their platforms and asking that they fully comply with the health and safety laws of countries they are selling in.

It's unfair that "physically-located companies have to adhere to national laws and internet companies seemingly don't," said Bender. "If it's illegal domestically, it should be illegal online."

Current legal regulatory frameworks in many countries worldwide fail to adequately protect consumers from hazardous, counterfeit and illegal products sold online, according to the report, which publishes Thursday.

"Many countries around the world, including in the EU, have regulation in place for mercury in skin creams but the creams are just penetrating the market," said Elena Lymberidi, Policy Manager at the Zero Mercury Campaign and fellow coordinator for the ZMWG.

Lymberidi wants clear liability rules to be established by national governments and for consumers to be provided with the same information online that they would see in stores, such as labelling information and the full disclosure of ingredients.

The skin whitening industry is estimated at $8 billion worldwide and is predicted to reach $11.8 billion by 2026. Studies suggest that women account for almost 80% of sales worldwide.

Mercury has long been used in skin whitening products due to its ability to block the production of melanin in the skin -- the pigment that gives color to skin. It is extremely toxic to health at high levels and can impact the body in various ways.

"Mercury is easily absorbed through the skin and can cause rashes, allergic reactions, and even kidney damage and nervous system disorders. It may also result in harmful changes in the placenta, subsequently causing damage to the fetus during pregnancy, and it can pass to children through skin-to-skin contact," explained Lymberidi. Studies have shown that households may also become contaminated.

A total of 36 brands made products identified by the ZMWG as containing high levels of mercury and the majority were available in multiple countries and continents through a range of online platforms. Among these were some of the products by brands such as Pakistan-based companies Goree, Aneeza, Faiza, Chandni and Noor, Thailand-based Kim,

China-based Jiaoli, and Mexico-based La Tia Mana. All but La Tia Mana had been identified in previous ZMWG reports but continue to contain high levels of mercury and be available online, according to the latest report.

"When we look year after year, we see the same brand names and the same products showing up all over the world," said Bender.

Multiple other reports and public health lists have also identified most of these brands as containing toxic levels of mercury.

When asked for comment, Goree told CNN that its creams contain less than 1ppm mercury but did not respond to further questions or requests for comment regarding the latest ZMWG findings, which found the cream to contain 21699 ppm mercury.

On its website, Goree warns that fake products, including one named 'Goree whitening cream' are being sold using the company's name and brand and cautions that these products contain high levels mercury. The company clarifies that its product is 'Goree beauty cream.' However, this latter named product is one of the creams obtained and tested by ZMWG in its report, as well as 'Goree Day and Night cream' which the company also makes, according to its website.

Chandni, Aneeza, Faiza, Noor and Kim did not respond to CNN's request for comment and CNN was unable to find a valid contact for Jiaoli, despite multiple enquiries with online sellers.

La Tia Mana informed CNN that products resembling theirs were once made by a separate company in Mexico and are now discontinued. The company claimed the products tested by ZMWG were these discontinued products, adding that their own product is homemade using ingredients bought in the US. When asked for more clarity, the company did not respond.

Regulating the sale of mercury-containing products: online retailers respond

Bender and Lymberidi explained that while platforms often take products down when informed of their sale, they often appear again later.

For example, CNN contacted eBay in December highlighting the availability of Chandni beauty cream and Goree day and night cream on its site based on the findings of the 2019 ZMWG report. The products were taken down but in February, Chandni beauty cream was available again through a different seller.

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eBay told CNN it employs "a combination of digital and manual surveillance tools to remove products that do not comply with applicable health and safety regulations including skin lightening products containing banned ingredients hydroquinone and mercury." The company said it has blocked over 10,000 listing attempts for prohibited skin lightening products, but when asked why these measures are not working, given that products continue to be available on its platform, eBay did not respond.

According to the report, a greater number of the skin whitening products tested by ZMWG and found to contain high levels of mercury were available on eBay, Ubuy, Shopee (owned by Sea Limited) and Flipkart. Mercury-containing products were also purchased on Daraz and Aliexpress, both part of the Alibaba group, and two creams were bought on Amazon's India site and Amazon.com.

Ubuy did not respond to CNN's request for comment in time to publish.

Bender acknowledges that Amazon appear to have cracked down on sales of these products in the US, adding that this is probably due to the lawsuit brought against the company in 2019 for failure to warn customers about toxic levels of mercury in the skin whitening products it sells. A California court ruled Amazon was exempt from liability for the products sold by third-party sellers.

Amazon removed listings for the two products purchased by ZMWG when CNN informed them of the mercury levels they contained. As with eBay, Amazon told CNN in a statement that it monitors its store and has "proactive measures in place to prevent prohibited products from being listed." It added that third party sellers are required to follow all applicable laws, regulations, and Amazon policies when listing items for sale and those who violate policies are subject to action including potential removal of their account.

Shopee, Flipkart, Daraz and Aliexpress gave similar responses to those from Amazon and eBay. The four companies all explained that the sale of illegal or hazardous products is prohibited on their sites and that sellers are expected to follow local regulations and company policies. The companies also outlined checks and monitoring systems they have in place to prevent or remove products that violate these policies.

Shopee added that it works with local governments and health authorities to take down listings that are flagged as containing high levels of mercury.

The company also encouraged users to reach out to Shopee if they encounter similar listings on its platform.

Flipkart added that it uses a combination of artificial intelligence and manual interventions to track adherence to the law and to its terms of use.

CNN additionally asked all six e-commerce sites why their surveillance measures were failing to work, given products containing mercury remained easily accessible. They were also asked what more would be done now that this report has highlighted an ongoing problem.

Daraz and Aliexpress explained that they continuously update their measures to ensure users access safe and trusted products. "We will continue to do so and take required action should there be sellers and products that don't meet our safety standards and our code of compliance," they told CNN.

Amazon, eBay, Flipkart and Shopee did not address the above two questions in their responses.

Promee's story

Promee Tasneem, 28, is a schoolteacher in Dhaka, Bangladesh. Two years ago, she wanted to become fairer skinned ahead of her wedding and began using two of the creams identified to contain high levels of mercury in the report, which she purchased on one of the sites named in the report, she told CNN.

"I have always been a little on the darker side and had dark circles [around my eyes]. So, in March 2020, nine months before I was to get married, I ordered the two fairness creams," she told CNN.

She used the two creams intermittently for eight months and began seeing results just one month into using them. But seven months later, the side effects began. "I had become fairer, but I had also started developing red rashes below my eyes, which was where I would put more of the cream," she said. "Soon, my eyes started watering all the time and I went to a doctor who told me that what's happening to me is a side-effect of the creams I am using."

On instruction from her dermatologist Promee stopped using the products immediately, but her rashes became worse before they got better. "Even now, I cannot use any cream -- and I have red spots all over," she said. "If need be, I use aloe vera to moisturize my skin."

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Her advice to others tempted by the promise of fairer skin is to avoid these creams at all costs.

"I can only warn people to not use these creams," Promee said. "Temporary beauty is not worth lifelong troubles."

CNN, 9 March 2022

https://edition.cnn.com

How poo transplants and changes in your gut microbiome might affect your mood

2022-03-06

It took poo donated by strangers for Tony* to finally feel unshackled of his debilitating bipolar disorder.

"It was the first time in 27 years that I could really say I felt normal, which is very weird," the Sydneysider says.

"It's a strange feeling to have control which, look, it's an amazing experience."

Tony's story was outlined in a recently published case study — one of only two such reports so far where people with bipolar disorder found their symptoms drastically improved after they received faecal microbiota transplantation, or poo transplants.

A few months into his six-month course of transplants, administered first in a clinic then at home, Tony's depressive phases dwindled, and his severe manic episodes stopped altogether.

Jane Dudley experienced a similar shift in her severe bipolar symptoms after opting for faecal transplantation in 2016.

"At that point, I was very, very ill, and being hospitalised a couple of times a year," says Jane, who is also from NSW and the subject of the other case study, which was published in 2020.

"I was desperate. The level of suffering was just unbelievable."

Three months after starting her poo transplants, she started noticing the world being brighter and happier.

"Now I'm coming up to five years without serious depression, and September 2017 was the last time I was manic," she says.

"I don't think I'd be alive today if I didn't do [poo transplants]."

In time, and under the careful supervision of their respective psychiatrists, both Jane and Tony went off their medication.

They, and their medical specialists, are not alone in suspecting another person's poo — and, more specifically, the microbes within it — have the power to treat psychiatric conditions.

The aim is to replace the recipient's "bad" gut bacteria with the donor's "good" bacteria

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While poo transplants are nowhere near an approved clinical treatment for mental health disorders, it's an idea that's gaining traction in research and clinical circles.

For instance, just last month, a Swiss team reported depression symptoms temporarily improved in two women after they swallowed "crapsules" containing poo from healthy donors.

Anecdotal evidence abounds too, with doctors hearing stories of people with no history of depression who became depressed after receiving a poo transplant from someone — you guessed it — with depression.

So how can the activities of microorganisms in our gut affect what goes on up in our skull?

And could we harness the power of "crapsules" to one day help shore up our mental health — or even mend minds?

More than a gut feeling

Modern science has only relatively recently begun exploring how the trillions of bacteria, fungi and other microbes that dwell in our gut — known collectively as the gut microbiome — can affect the rest of our body.

The vast majority of studies into what's known as the microbiome-gut-brain axis have, so far, been done with mice and rats.

In 2004, Japanese researchers reared mice with no microbiome and found they were more stressed than mice with some microbes left in them.

When some beneficial gut bacteria were put back into baby "germ-free" mice, they grew up less stressed than their completely sterile counterparts.

In the years since, research into links between mental health and the human gut microbiome has exploded — pushed along by studies such as an Irish one in 2016, which found if you put poo from a depressed human into a rat, that rat will start displaying depression-like symptoms.

Researchers from the same institute last year found old mice, aged around 20 months, reversed some age-related cognitive decline if they received a poo transplant from mice who were only a few months old.

Yeah, but what about in humans?

Studies in rodents and case studies like Tony and Jane's are compelling, but researchers don't yet know exactly how poo transplants truly work, or why effects vary between people.

We do know our gut and our mood are linked, and it's more than occasionally feeling butterflies in your stomach.

Studies and surveys have found correlations between gastrointestinal and psychiatric disorders. For instance, one review found 44 to 84 per cent of people with irritable bowel syndrome also had anxiety and/or depression.

And how we mediate our mood through medication can affect how our tummy feels: for some people, anti-depressants and therapy can ease irritable bowel syndrome.

In the past few years, research has moved from association studies, which note that the gut microbiome is different between healthy and people with a disease, and into studies that aim to elucidate exactly how these differences affect health.

There are plenty who would dismiss case studies such as Tony and Jane's experiences as … well, a load of crap, says Emad El-Omar, a gastroenterologist at UNSW and Microbiome Research Centre director.

"But if you think about the basis of that intervention, demonstrated in [Tony's] case report, it's absolutely solid, because there's nothing more intertwined — the gut and the brain," Professor El-Omar says.

"It's connected in so many different ways."

Gut bugs and our 'second brain'

Our gut microbiome's main role is to help us digest food we normally couldn't break down. Some of our bacteria chop up long chains of complex carbohydrates into smaller chunks.

These ferment and produce short-chain fatty acids, which we can then use as a source of nutrients.

But all those colonies of microbes lining our gut wall spit out their own suite of compounds or metabolites as they go about their own existence.

These metabolites slip through our intestinal wall, out of the gut, and into the rest of the body.

And they're not necessarily good for us either.

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If nastier microbiome-made metabolites encounter the plethora of immune cells surrounding the digestive system, they can end up fanning the flames of inflammation — and chronic inflammation is increasingly implicated in conditions such as depression.

They can tinker with our hormones, activating or calming our central stress response system.

Metabolites can even interact directly with the 100-million-odd nerves embedded in the muscular walls of our gut.

This enteric nervous system, sometimes called our "second brain", communicates directly with the brain in our head.

But complicating matters for researchers trying to tease out how the microbiome affects our brain is how these systems — immune, hormonal, neuronal — influence each other, Professor El-Omar says.

"You can't exclude the immunology from the microbiology, or the physiology from whatever — they must all work together. They're all linked up.

"Whatever leaks out of one compartment will affect many others."

Why aren't poo transplants used in mental health now?

Your microbiome changes depending on what you eat, where you live, who you live with and the medications you take.

But the quickest way to change up your microbiome is via a poo transplant — and this is an advantage when it comes to treating severe illness, Professor El-Omar says.

In Australia, faecal microbiota transplantation is only approved to treat intestines overwhelmed by a species of bacteria called Clostridium difficile.

Like any ecosystem, when one species dominates, it can wreak havoc on its environment. But poo transplants work exceptionally well to rebalance the gut microbiome after C. difficile overgrowth, with around a 90 per cent success rate.

Donations come from stool banks, such as Adelaide's BiomeBank, which carefully screen donors to make sure they're healthy — physically and mentally — so they don't inadvertently pass anything onto recipients.

But poo transplants and the brain?

Nailing down the right donor for a recipient will be crucial, Professor El-Omar says.

And that's complicated.

"Which poo are you going to be accepting as a treatment for a particular condition? Is it the right one to drive changes back to normal?

"Plus we still don't understand why a particular transplant will establish itself [in the recipient's gut] and be consistently happy in that new environment."

People might need a couple of top-ups or boosters after their initial round of treatment, he adds.

ABC News, 6 March 2022

https://abc.net.au

Are there any moons that are made of gas

2022-03-07

The planets in our solar system come in two forms: Some are rocky, and some are gaseous. But all of the moons in our solar system are rocky, even the ones that orbit gas giants. So why aren't some moons in the solar system made of gas? And are there gaseous moons anywhere in the universe?

There are some very good reasons why no nearby moons are gaseous. And while we haven't found a gaseous moon beyond our solar system, it could be possible under the right conditions, said Jonathan Lunine, chair of the Department of Astronomy at Cornell University.

Specifically, it would depend on the moon's mass, its surrounding temperature and the influence of tidal forces — that is, the gravitational pull of a nearby body, like its host planet.

To illustrate how these conditions might affect a gaseous moon, imagine that our own moon's rocky composition were replaced with pure hydrogen. Hydrogen gas is much less dense than rock, so right away, the moon would grow to about the size of Earth, Lunine said.

In fact, the enormous size of gas giants like Jupiter is one reason they can exist. If they were too small, the force of gravity wouldn't be powerful enough to hold those light elements together.

But size isn't the only factor at play; there's also temperature.

While we haven't found a gaseous moon beyond our solar system, it could be possible under the right conditions

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"Let's take the moon as it is — as a rock," Lunine told Live Science. "And then let's put a hydrogen atmosphere around it. We know that hydrogen atmosphere is going to escape very quickly just due to thermal effects." In other words, the warmth of the sun would cause the hydrogen to evaporate away.

"And so what that would tell me is, an entirely hydrogen-composed Earth's moon at the distance of the Earth from the sun is not going to be stable," Lunine said. That's true even as far out as Pluto's orbit, he added.

But even if our imaginary gas moon were the size of Earth and the surrounding temperature were very cold, its host planet would still probably rip it apart.

"Remember that the Earth's moon is subject to tidal forces from the Earth," Lunine said. "So it's actually not a sphere. It's pulled out a bit, but it doesn't get torn apart because it has some material strength associated with it."

That's not the case with the hypothetical gaseous moon. "Because it's a gas and not a solid — even if it's very cold — if it's orbiting around something else, it's going to get tidally stripped and torn apart by tides," Lunine said.

So how could a gaseous moon ever be possible? The moon-planet system would have to be either very distant and cold, or very big.

"If it's the size of our moon, anywhere in our solar system, it's not going to work right. Way out in the depths of interstellar space? There, it's a question mark," Lunine said. "If you want to make something super big, like a Neptune around a Jupiter, then sure, you can do it."

In that case, the gravitational forces holding these huge bodies together would likely keep tidal forces from destroying the Neptune-size moon.

"That could be perfectly stable," Lunine said.

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https://livescience.com

When is a pandemic 'over'?

2022-03-04

Every 3 months since January 2020, when it first named the SARS-CoV-2 outbreak an international public health emergency, a committee of expert advisers to the World Health Organization (WHO) has convened to assess

whether the pandemic still merits that label. And every 3 months, most recently in January, the advisers have unanimously agreed it does, and WHO Director-General Tedros Adhanom Ghebreyesus has accepted their verdict. When the committee meets again next month, it is likely to reach the same conclusion–and Tedros is again likely to accept it.

But at some point—estimates range from months to years from now—WHO will make a different call. Already, nations such as Denmark, the Netherlands, and the United Kingdom have functionally declared an end to the pandemic in their countries, lifting almost all health restrictions even as New Zealand and Hong Kong struggle with record-breaking surges. Deciding when to sound the all-clear is "not an enviable task," says Yonatan Grad, an infectious disease epidemiologist at the Harvard T.H. Chan School of Public Health (HSPH). "Do you call it over when there might still be a wave in one part of the world but it's a small part?"

"SARS-CoV-2 has caused such hardship and economic challenges that there will be a temptation to call it as over sooner rather than later," says Salim Abdool Karim, an epidemiologist who is the South African government's chief COVID-19 scientist. The prospect worries him. WHO's formal declaration of a Public Health Emergency of International Concern (PHEIC) legally binds 196 signatories to follow WHO's recommendations during the emergency. Drugmakers have also signed contracts agreeing to make anti–SARS-CoV-2 pills more affordable until the PHEIC is reversed. Other big, cooperative efforts "that were put in place to make diagnostics, vaccines [affordable and to distribute them worldwide], all of those things … will fall away. And those are the mechanisms that are needed by the poor countries," says Karim, who also runs the Centre for the AIDS Programme of Research in South Africa. "Getting it wrong will carry a high price."

To many outside China, where COVID-19 struck first, a statement by Tedros 2 years ago this week describing SARS-CoV-2 as a global pandemic marked its official start. But his 11 March 2020 comments triggered no public health requirements. Rather, the declaration with practical implications was the 30 January 2020 PHEIC announcement.

The regulations governing the PHEIC require signatory nations to report suspect outbreaks to WHO and to support its responses, although WHO has no way to enforce those rules. The expert committee that recommends whether to continue the PHEIC also lists, with each renewal, actions that nations should take, such as improving variant surveillance and expanding each nation's vaccination coverage. At the start of this year,

World Health Organization prepares to confront thorny decision

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for instance, the emergency committee added a new recommendation: Monitor and share data on cases and evolution in animals.

The decision to end a PHEIC has financial implications, too. Moderna has pledged not to enforce patents on its messenger RNA vaccine until the pandemic ends, although a company spokesperson declined to say this week how it will identify that moment. Pfizer has not made a similar vaccine pledge, but it and Merck have agreed to allow generic drugmakers to make their drugs targeting SARS-CoV-2 until WHO declares the PHEIC is over. Dozens of companies have now signed up to make Merck's molnupiravir and Pfizer's Paxlovid for a long list of mostly low- and lower-middle-income countries.

Ending the PHEIC will also impact major pandemic-related programs such as the COVID-19 Vaccines Global Access (COVAX) Facility and its parent, the Access to COVID-19 Tools (ACT) Accelerator—cooperative global networks that aim to acquire and distribute affordable drugs, diagnostics, and vaccines. "The emergency operations of COVAX and ACT-A will go away—it's hard to keep that up," says Seth Berkley, CEO of GAVI, the Vaccine Alliance, which is integrally involved with both efforts. "The hope is that the core innovations–the ways of working all of that—will be kept warm" for the future.

WHO's 18-member committee uses three criteria to decide when to declare a PHEIC and when to lift it. A public health event must be "serious, sudden, unusual or unexpected"; likely to spread internationally; and likely to require immediate international action. When unwinding an emergency, the committee considers such metrics as vaccinations and case numbers. But the criteria are more social and political than scientific, says Caroline Buckee, an infectious disease epidemiologist at HSPH. "There's not going to be a scientific threshold. There's going to be an opinion-based consensus," she says.

Complicating the decision is the prospect of further harmful variants arising, including, potentially, from some 20 animal species now known to host the virus. "I don't know how it ends," says Michael Osterholm, an infectious disease epidemiologist at the University of Minnesota, Twin Cities.

Karim says the real end of the pandemic won't come until the arrival of a "final variant [that] even if it mutates, can't do better … than the previous version" in spreading and in escaping immunity. "If I was a betting man, I would say probably in about 2, 3 years we will get to that point."

WHO was conservative in lifting previous PHEIC declarations–there have been six including SARS-CoV-2 since the regulations took effect in 2007—says Horace Cox, director of vector-borne diseases at the Ministry of Public Health in Guyana, and he expects the same with SARS-CoV-2. Individual countries have been less gingerly signaling a return to normal, however. Several European countries have lifted restrictions already. And the U.S. Centers for Disease Control and Prevention last week eased masking recommendations for some 70% of the United States. In Congress, Republicans are this week trying to block additional pandemic funding, and some have introduced a bill to end the federal emergency declared in March 2020.

"The expectation is that the United Kingdom and the U.S. will be well ahead in terms of advancing to the stage where they say: 'We don't think this is an issue anymore. We're making our own decision,'" Cox says. "[But] the WHO [must] consider what is good for the entire world."

Still, he is cautiously optimistic that a WHO determination that the PHEIC is over may not be too distant. "If I were to make an educated guess, I would say that perhaps by late second and third quarter [2022]," if another deleterious variant doesn't emerge.

But Osterholm is making no predictions. "If there was ever a time for humility among scientists and policymakers with this virus, it's now," he says. "We are in totally uncharted territory from the perspective of understanding what a pandemic is, how it starts, how it unfolds and how it ends."

Science, 4 March 2022

https://science.org

How does the brain make memories?

2022-03-07

Researchers have discovered two types of brain cells that play a key role in dividing continuous human experience into distinct segments that can be recalled later. The discovery provides new promise as a path toward development of novel treatments for memory disorders such as dementia and Alzheimer's disease.

In a study led by Cedars-Sinai, researchers have discovered two types of brain cells that play a key role in dividing continuous human experience into distinct segments that can be recalled later. The discovery provides new promise as a path toward development of novel treatments for memory disorders such as dementia and Alzheimer's disease.

To retrieve memories, the brain uses boundary peaks as what Rutishauser calls "anchors for mental time travel."

The study, part of a multi-institutional BRAIN Initiative consortium funded by the National Institutes of Health and led by Cedars-Sinai, was published in the peer-reviewed journal Nature Neuroscience. As part of ongoing research into how memory works, Ueli Rutishauser, PhD, professor of Neurosurgery, Neurology, and Biomedical Sciences at Cedars-Sinai, and co-investigators looked at how brain cells react as memories are formed.

"One of the reasons we can't offer significant help for somebody who suffers from a memory disorder is that we don't know enough about how the memory system works," said Rutishauser, senior author of the study, adding that memory is foundational to us as human beings.

Human experience is continuous, but psychologists believe, based on observations of people's behavior, that memories are divided by the brain into distinct events, a concept known as event segmentation. Working with 19 patients with drug-resistant epilepsy, Rutishauser and his team were able to study how neurons perform during this process.

Patients participating in the study had electrodes surgically inserted into their brains to help locate the focus of their epileptic seizures, allowing investigators to record the activity of individual neurons while the patients viewed film clips that included cognitive boundaries.

While these boundaries in daily life are nuanced, for research purposes, the investigators focused on "hard" and "soft" boundaries.

"An example of a soft boundary would be a scene with two people walking down a hallway and talking, and in the next scene, a third person joins them, but it is still part of the same overall narrative," said Rutishauser, interim director of the Center for Neural Science and Medicine and the Board of Governors Chair in Neurosciences at Cedars-Sinai.

In the case of a hard boundary, the second scene might involve a completely different set of people riding in a car. "The difference between hard and soft boundaries is in the size of the deviation from the ongoing narrative," Rutishauser said. "Is it a totally different story, or like a new scene from the same story?"

When study participants watched film clips, investigators noted that certain neurons in the brain, which they labeled "boundary cells," increased their activity after both hard and soft boundaries. Another group of

neurons, labeled "event cells," increased their activity only in response to hard boundaries, but not soft boundaries.

Rutishauser and his co-investigators theorize that peaks in the activity of boundary and event cells -- which are highest after hard boundaries, when both types of cells fire -- send the brain into the proper state for initiating a new memory.

"A boundary response is kind of like creating a new folder on your computer," said Rutishauser. "You can then deposit files in there. And when another boundary comes around, you close the first folder and create another one."

To retrieve memories, the brain uses boundary peaks as what Rutishauser calls "anchors for mental time travel."

"When you try to remember something, it causes brain cells to fire," Rutishauser said. "The memory system then compares this pattern of activity to all the previous firing peaks that happened shortly after boundaries. If it finds one that is similar, it opens that folder. You go back for a few seconds to that point in time, and things that happened then come into focus."

To test their theory, investigators gave study participants two memory tests.

They first showed participants a series of still images and asked them whether or not they had seen them in the film clips they had viewed. Study participants were more likely to remember images that closely followed a hard or soft boundary, when a new "memory folder" would have been created.

Investigators also showed participants pairs of images from film clips they had viewed and asked which of the images appeared first. Participants had difficulty remembering the correct order of images that appeared on opposite sides of a hard boundary, possibly because the brain had segmented those images into separate memory folders.

Rutishauser said that therapies that improve event segmentation could help patients with memory disorders. Even something as simple as a change in atmosphere can amplify event boundaries, he explained.

"The effect of context is actually quite strong," Rutishauser said. "If you study in a new place, where you have never been before, instead of on

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your couch where everything is familiar, you will create a much stronger memory of the material."

The research team included postdoctoral fellow Jie Zheng, PhD, and neuroscientist Gabriel Kreiman, PhD, from Boston Children's Hospital; neurosurgeon Taufik A. Valiante, MD, PhD, of the University of Toronto; and Adam Mamelak, MD, professor of Neurosurgery and director of the Functional Neurosurgery Program at Cedars-Sinai.

In follow-up studies, the team plans to test the theory that boundary and event cells activate dopamine neurons when they fire, and that dopamine, a chemical that sends messages between cells, might be used as a therapy to strengthen memory formation.

Rutishauser and his team also noted during this study that when event cells fired in time with one of the brain's internal rhythms, the theta rhythm -- a repetitive pattern of activity linked to learning, memory and navigation -- subjects were better able to remember the order of images they had seen. This is an important new insight because it shows that deep brain stimulation that adjusts theta rhythms could prove therapeutic for memory disorders.

"Theta rhythms are thought to be the 'temporal glue' for episodic memory," said Zheng, first author of the study. "We think that firing of event cells in synchrony with the theta rhythm builds time-based links across different memory folders."

The study was funded by National Institutes of Health Grants number U01NS103792 and U01NS117839, National Science Foundation Grant number 8241231216, and Brain Canada.

Science Daily, 7 March 2022

https://sciencedaily.com

'Maladaptation': how not to cope with climate change

2022-03-05

A crescendo of deadly extreme weather is outpacing preparations for a climate-addled world, according to a landmark UN assessment of climate impacts released this week.

Whether it is sustainable farming or bioengineered crops to boost food security; restoring mangrove forests or building sea dams to buffer rising oceans; urban green corridors or air conditioning to temper killer

Sea walls, dykes and flood-control gates can "create long-term lock-in of vulnerability, exposure and risks," according to the IPCC report on climate impacts.

heatwaves—the search for ways to cope with the fallout of global heating has become urgent.

"At current rates of adaptation planning and implementation, the adaptation gap will continue to grow," the Intergovernmental Panel on Climate Change warns.

At the same time, however, the 3,650-page IPCC report raises red flags about how schemes to deal with climate impacts can go wrong.

There's even a word for it: "maladaptation".

"We're finding that there are many cases in which adaptation projects don't work," said Clark University professor Ed Carr, lead author of a chapter in the IPCC report on climate resilient development. "Some have actually made things worse."

Building a dam, for example, to prevent urban flooding may help protect a small area for a limited time period.

"But if the measure you put in place has negative consequences along the rest of the river and makes things worse in the long run, that's maladaptation," said Imperial College London's Friederike Otto.

Otto, a pioneer in quantifying the extent to which climate change makes extreme weather more likely or intense, said people often fail to recognise the role bad choices—building houses in a flood plain, for example—play in disasters.

Lack of data

"Just blaming climate change alone can lead to maladaptation," she told AFP.

Sometimes coping measures have unintended consequences.

Kwame Owusu-Daaku, an assistant professor at the University of West Florida, investigated the aftermath of sea barriers erected in front of a modest fishing village near the Volta River estuary in Ghana to prevent beach erosion due to storm surges and rising seas.

The sea walls worked. In fact they worked so well that a large real estate developer—hand in glove with the local government—took over the land to build luxury, beach-front chalets.

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"The people who lived there were kicked off the land," Owusu-Daaku said in an interview, calling the outcome an example of "maladaptation opportunism".

No only was this unfair, it is probably unsustainable too, according to the IPCC report.

Sea walls, dykes and flood-control gates "create long-term lock-in of vulnerability, exposure and risks that are difficult and costly to change," it said.

And while hard engineered structures may protect against hazards up to a certain point, they also create "an illusion of no risk".

Another source of maladaptation is lack of data.

"You can only adapt to what you know," said Mohamed Adow, founder and director of the Nairobi-based Africa Power Shift.

"In the case of Africa, we know very little. How do you create early warning systems for extreme weather without data?", he told AFP.

Not well thought-out

In a world where new infrastructure—roads, buildings, sewage systems—must serve both development and adaptation objectives, a lot of construction is probably not fit for a 1.5C world, much less one that could warm 2C or 3C above pre-industrial levels, experts say.

The Earth's average surface temperature has already risen 1.1C compared to that benchmark.

"Maladaptation happens when you try to solve one problem and wind up creating another," said Patrick Verkooijen from the Global Center on Adaptation.

"There are so many examples of well-intentioned measures that are not thought through in a holistic way."

A study of more than 300 initiatives for coping with climate change cited in the IPCC report found that one-third may have unintended and negative consequences.

A more detailed analysis of three projects in Cambodia—promoting irrigation, forest protection and tree planting—"found evidence that local communities' rights being violated and destruction of biodiverse habitats."

The potential for maladaptation "had been ignored by international donors as well as national authorities," the report concluded.

Other types of maladaptation are recurrent, especially in the global South.

Eighty percent of land used to grow food is rain-fed, and thus highly vulnerable to droughts made worse by rising temperatures. In parts of Africa, more frequent dry spells will likely double in length in a 2C world.

The most common adaptation response to drought is irrigation, but this potentially vital solution can cause problems of its own.

The adaptation COP

Extracting groundwater for irrigation can deplete aquifers, which in turn can make water unsuitable for human consumption and aggravate drought conditions.

For heatwaves, air conditioning can be a literal life-saver, especially in regions projected to see an increase in so-called deadly heat days.

"But at the societal level, it is maladaptive because of its high demands on energy and associated heat emissions, especially in high-density cities," the report warns.

And expensive: A study in the Vietnamese capital Hanoi found that some people don't use air conditioners purchased to keep cool at night because they cost too much to run.

In the UN climate negotiations launched 30 years ago, adaptation has always been a poor cousin to goal of curbing greenhouse gas emissions.

But the COP26 climate summit in Glasgow last Fall helped restore a balance, launching a two-year process to define adaptation goals and mobilise financing.

"Sharm-El-Sheikh must be seen as the adaptation COP," said Adow, referring to the next year-end climate meet in Egypt.

A major goal of the political process will be to avoid the kinds of maladaptation highlighted by the IPCC.

"We have waited so long to tackle climate change that we are already paying the price today of climate impacts," said Verkooijen.

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"But that doesn't mean we shouldn't invest in adaptation for tomorrow, because the costs are only increasing over time if we don't act."

Phys Org, 5 March 2022

https://phys.org

Why Birth Control Side Effects Have Eluded Science

2022-03-07

IN AUGUST 2021, Emilie Skoog lay on the couch in her parents' living room, thinking that not a single thing in the world sparked joy. For weeks, the 25-year-old MIT graduate student had been unable to muster enough appetite to eat properly. Instead, she'd spend full days lying in bed, drifting in and out of sleep between sips of Gatorade.

The depression had set in about two months earlier, Skoog said, just after she'd started taking hormonal birth control pills to ease the debilitating cramps she experienced around the time of her period, which rendered her housebound for a few days each month.

Birth control users say that the drugs can alter their moods. Why have scientists struggled to find a link?

"I'm a very upbeat, happy person," Skoog said. But that first month taking the pills, she recalled, a fog of exhaustion and apathy replaced her usual cheerful mood. When she walked to the lab where she worked, she added, "I didn't even care to look both ways across the street."

Skoog says her doctor diagnosed her with depression and prescribed antidepressants that helped her get off the couch and back to her life. But it wasn't until she followed the advice of a friend, who suggested she try going off the birth control, that the depression truly lifted, she said: "I swear to you, the day I stopped taking it, I literally felt completely normal."

Oral contraceptives were approved in the 1960s, and since then, studies suggest, the medications have benefitted large segments of society. Still, concerns about possible side effects linger. Researchers have looked for a connection between hormonal birth control and mental health issues like anxiety and depression. But despite the stories like Skoog's that circulate on social media, in sisterly social groups, and in doctors' offices, these studies have not consistently supported a link. For now, while the connection between birth control and mental health may seem obvious to many of the drugs' users, a true link remains elusive to researchers.

HORMONE-BASED birth control works primarily by mimicking key aspects of pregnancy. At the end of each monthly cycle, people who menstruate have natural hormonal lows that tell their bodies they're not pregnant.

Birth control keeps hormone levels high, as they are during pregnancy, with one consequence being that eggs stay locked away where they can't be fertilized.

There's ample reason to believe that tinkering with sex hormones might affect a person's mood. Conditions such as anxiety and depression often manifest during puberty and menopause, when hormones are undergoing natural fluctuations. When birth control first came on the market, it didn't take scientists long to begin studying whether these new drugs could also influence their users' psychology. But in 2018, when researchers from Ohio State University looked at 26 studies examining the link between some of the most common types of birth control and depression, they wrote, "the preponderance of evidence does not support an association."

Brett Worly, an OB-GYN based in Columbus, and one of the authors of the meta-analysis, said that performing the study changed how he talks to his patients. Before, he cautioned prospective birth control users that the drugs might cause depression — because some reports indicated this might be the case — but now he tells them that's unlikely. Worly admits, however, that his advice is based only on the best evidence that's available right now. The study he'd like to see has yet to be done.

"It would have to be like hundreds or maybe thousands of women over at least six months to a year," he said. Ideally, the study would be performed by independent researchers unaffiliated with pharmaceutical companies, to avoid any bias. Participants would be randomly assigned to take birth control or placebo pills, and researchers would periodically assess depression, anxiety, and a range of mood changes.

But this gold standard approach has a downside for participants: The placebo group would be susceptible to unwanted pregnancies. Participants would need a secondary, non-hormonal form of birth control, but here the options are limited. A copper intrauterine device, or IUD, is the obvious choice for its effectiveness, but insertion is invasive, and heavy, painful periods can be a common side effect. Condoms are an option, but barrier methods are prone to human error and tend to be less effective than hormonal contraceptives. "It's a hard study to do," Worly said. "Hopefully, eventually, that would happen. It hasn't happened yet the way that we need it to."

Even a group with the capability to complete the study would face an additional challenge: Scientists say they lack the tools to accurately assess many of the mental health side effects that birth control users may experience. Worly and his co-authors focused their meta-analysis

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on depression because it's a specific, widely studied condition that researchers have standard ways of diagnosing. The main symptoms of depression include feelings of worthlessness, hopelessness, and fatigue, but birth control users have reported that the drugs can make them cry more easily, feel anxious, or feel oddly emotionless — conditions that are assessed by some depression questionnaires, but which don't qualify as depression on their own.

WOMEN'S HEALTH PHYSICIAN Ellen Wiebe runs an abortion clinic in Vancouver, British Columbia, where she often has conversations with her patients about why birth control failed them. "Over and over again, I had heard that she tried birth control," Wiebe said, "and she went crazy."

She asked her patients what they mean when they say they feel crazy. "They told me that they would get angry more easily, that they would cry more easily, that they would just overreact to stuff," Wiebe said. And so she designed a survey to examine these subtle mood changes. The rate of mental health side effects that she uncovered was far higher than the rates she was used to seeing in physician manuals— of the 978 respondents in the self-reported survey, 51 percent had experienced at least one negative mood-related side effect.

Wiebe said she thinks her research uncovered such a high rate because she designed her survey around the side effects that birth control users reported to her, like disinterest in sex and irritability. And she noted that even comparatively mild mood changes can have a serious impact on well-being: "A combination of being angry and not wanting to have sex is not good for relationships," Wiebe said. "I remember one woman telling me, 'I lost the love of my life.'"

Wiebe's results may not hold for all populations, however. She and her collaborators recruited participants in doctors' offices, "so right there you have some selection bias," Andrew Novick, a reproductive psychiatrist at the University of Colorado, wrote in an email to Undark. Women who feel well on their medications are less likely to visit a doctor than those who are experiencing negative side effects.

Worly says he thinks the survey is a nice contribution to scientists' understanding of mood-related side effects. But he cautions that asking participants to remember how they felt, potentially years earlier, as the study's authors did, could introduce recall bias. And a critical component of his ideal experiment was missing: "There was no 'control group,' to correct for other circumstances that may have affected women, like change in seasons, change in relationship, and more," he wrote.

Lorraine Boissoneault, a journalist from the Chicago area, knows how hard it can be to disentangle mental health side effects from other factors. She struggled with mood swings from the time she started taking birth control until she switched to a non-hormonal IUD, around six years later. "In my head, the thing that had changed, that seems like the obvious change, was birth control," she said. But during that same period, she noted, her personal life improved and she started getting treatment for a thyroid condition that had gone undiagnosed.

Novick says he's treated people who, like Boissoneault, experience mood swings while on birth control, people who experience more subtle changes, and people who actually feel better while taking these drugs. Further complicating the matter, anecdotes suggest that the same person can experience both ends of this emotional spectrum. Elizabeth Hinnant, a writer from Atlanta, found that one form of hormonal birth control left her feeling severely irritated, while another made her feel calmer than usual.

Variability, lack of specificity, and confounding circumstances make mood changes hard to measure, but Wiebe and Novick also pointed to a problem researchers face when studying any serious side effect — people like Boissoneault, Hinnant, and Skoog probably won't participate in studies testing drugs that they believe made their lives miserable, so studies don't capture this segment of the population. "It's something called the survivor effect," Novick said. Most studies are limited to studying women who are willing to take hormonal birth control. "And who are those women?" Novick asks. "Those women are the ones who want to stay on it."

BIRTH CONTROL USERS say they sometimes contend with stigma and dismissive attitudes as they try to address mood changes. Skoog says she consulted two doctors about whether birth control could be contributing to her depression. Both told her that was unlikely. Boissoneault, meanwhile, never talked to a doctor about her mood swings because, "I was scared of what people might say, or how they might react," she said. "So I kind of just gritted my teeth and tried to get through it."

Compounding the problem, some researchers may hesitate to speak out against drugs that have had undeniably positive impacts for large segments of society. One study found that the introduction of birth control correlated with a three-fold increase in the number of women enrolled in medical and law school. Another found that birth control may have helped narrow the wage gap. And studies consistently show that children are less likely to grow up in poverty when their parents have access to birth control. These gains were hard fought in the U.S. — the

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battle to keep birth control accessible has reached the Supreme Court multiple times. Novick remembers showing a colleague his first grant proposal to study birth control's mood-related side effects. "He was like, 'You got to tread carefully here,'" Novick said. "Because OB-GYNs are gonna get very defensive."

Some scientists think outdated views about physiology have also stymied research. Nafissa Ismail, a neuroendocrinologist at the University of Ottawa, said, "We've been studying the brain as its own entity for the longest time in the field of neuroscience and forgetting that it belongs to a body." It's only recently that a push to reconsider the body has prompted questions about how drugs targeting the uterus can translate to the brain, she added.

Medical imaging suggests that there may be significant translation from body to mind. Using brain scanning techniques like magnetic resonance imaging, researchers have observed that birth control may alter the number of cells — and the number of connections between them — in certain regions of the brain. These alterations may underly behavioral changes observed by Ismail and others, like differences between how birth control users and non-users respond to stress.

Ismail says that resources for this type of work are becoming more available — she cites the Canadian Institutes of Health Research and the U.S. National Institutes of Health as funding agencies that have expressed interest in research on birth control and mood. But after so many years of languishing in obscurity, these fields lack the number of researchers necessary to make rapid progress.

Meanwhile, Skoog said she's off hormonal birth control for good, and considering acupuncture to control her cramps. She's also helping friends track their own moods, just in case birth control skews their feelings into dangerous territory. "I imagine that there are many, many, many women out there who are going through this," she said.

Undark, 7 March 2022

https://undakr.org

How rare are shooting stars?

2022-03-14

An old superstition suggests that if you wish upon a shooting star, your wish will be granted. The implication is that shooting stars are so rare, and

your sighting so fortuitous, that you've been specially selected for a dose of good luck.

But are shooting stars actually all that elusive? And what are they, exactly?

A shooting star is a "common, if inaccurate, name for a meteor," or a space rock that collides with Earth's atmosphere, said Edwin Charles Krupp, an astronomer and director of the Griffith Observatory in Los Angeles.

Meteors that are called shooting stars appear as "a flash of light" to sky-gazers, Krupp told Live Science. "This light is the visible trail of gases in Earth's upper atmosphere [that are] heated to incandescence by the high-speed passage of a meteoroid, or meteoric particle, intercepting the Earth." Quite simply, a "shooting star" is a piece of space rock or dust that briefly becomes visible when it begins to burn up in our planet's atmosphere. Much of this material comes from the asteroid belt between Mars and Jupiter.

So, how common are shooting stars? How often do these flashy space rocks come into contact with Earth's atmosphere, and what's the best way to see them?

"Meteors occur all of the time, all over the Earth, but are only seen at night," Krupp said. Most extraterrestrial rubble that collides with the atmosphere is "very small, typically the size of a grain of sand," he added.

The number of meteors visible to the unaided eye under a truly dark sky in a 24-hour period all over Earth is estimated to be 25 million, according to a University of Oregon report. However, Earth also intercepts many smaller particles that are too faint to be detected by the unaided eye, Krupp noted.

In the dark

If you want to see shooting stars, it's important to find a dark sky location, Krupp said. Dark sky sites have very low levels of light pollution and allow uninterrupted views of the night sky.

Since 2001, the International Dark Sky Places conservation program, run by the International Dark-Sky Association (IDSA), has encouraged communities to "preserve dark sites through responsible lighting policies and public education." The IDSA also dictates whether a site can officially be called a "dark sky," and has, to date, awarded 195 areas around the world dark sky status.

The number of meteors visible to the unaided eye under a truly dark sky in a 24-hour period all over Earth is estimated to be 25 million, according to a University of Oregon report.

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Certain sites have "gold-tier dark sky" status, which is the IDSA's highest possible rating. Some of the best dark sky areas include Northumberland National Park in England, the largest gold-tier dark sky park in Europe; the Central Idaho Dark Sky Reserve, the first gold-tier dark sky preserve in the United States; and the Atacama Desert in Chile, which contains La Silla Observatory, home to some of the world's most powerful telescopes. (You can see a comprehensive list of the world's best dark sky sites at this page from the International Dark-Sky Association.)

Unfortunately, and largely due to human activity, pristinely dark skies are increasingly hard to find. According to the "World Atlas of Artificial Night Sky Brightness," around 80% of the world's population lives under "skyglow," which the U.S. Department of Energy defines as "an increase in the apparent brightness of the night sky that can serve to reduce visibility for astronomical observation." In the U.S. and Europe, it's estimated that 99% of people live under some degree of skyglow.

Starlink, Elon Musk's internet-enabling satellite network, is also causing issues for astronomers. Once fully operational, there could be 42,000 Starlink satellites orbiting Earth, something that has led the International Astronomical Union to create the Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference to "mitigate the negative impact of satellite constellations."

For most people, Krupp said, seeing a shooting star is a rare event because "we have lost the night sky to light pollution," which "unnecessarily denies us the stars." Krupp also believes that many of us are guilty of being "busied by other things" and, as a result, often don't take the time to look at and admire the sky. But he is confident that a person who deliberately and purposefully watches the sky on a clear night from a location "untarnished by artificial light" will be able to see "five to 10 meteors per hour," if not more.

"All you've got to do is go outside, find a nice dark spot, lie flat on your back and look up," Bill Cooke, head of NASA's Meteoroid Environment Office at the Marshall Space Flight Center in Alabama, previously told Live Science. "You don't want binoculars. You don't want a telescope. You just use your eyes."

There are also times throughout the year when people are more likely to see shooting stars. Meteor showers, which occur when Earth annually passes through the "persistent ring of debris shed by a comet," give stargazers a much better chance of seeing a host of shooting stars. These events can be predicted to the day, thanks to the reliability of Earth's

orbit around the sun. For instance, the Perseid meteor shower, which often peaks in August, can shower Earth with as many as 50 to 100 visible meteors per hour.

Shooting stars are, it would appear, far more common than most people think — you just have to look up at the right time and be in the right place.

Live Science, 14 March 2022

https://livescience.com

Are conferences worth time and money?

2022-03-14

Every year, hundreds of thousands of scientists spend tens of billions of dollars to organize and attend conferences.

Are scientific conferences truly worth this time and money?

The answer is yes, according to a new Northwestern University study. Scientists who interact with others during assigned sessions at conferences are more likely to form productive collaborations than scientists who do not, researchers found. And the kicker? It doesn't matter whether the conference is in person or virtual.

"Scientific conferences are a very expensive industry," said Northwestern's Emma Zajdela, the study's first author. "People often talk about whether or not we should rethink conferences. Our results suggest that the way organizers design conferences can have a direct effect on which scientific collaborations are formed and, by extension, on the direction of scientific inquiry."

Zajdela will present the study's results at 9:36 a.m. CDT on Thursday, March 17 at the American Physical Society (APS) March Meeting in Chicago. A pre-print of the study is now available online.

A National Science Foundation Graduate Research Fellow, Zajdela is a Ph.D. candidate in Northwestern's McCormick School of Engineering. Daniel Abrams, a professor of engineering sciences and applied mathematics at McCormick, is the paper's senior author and Zajdela's adviser.

To conduct the study, Zajdela, Abrams and their collaborators developed a new mathematical model to understand and predict how scientists form collaborations at both in-person and virtual conferences. Then, they validated the model with extensive data from Scialogs, a series of

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scientific conferences organized by the Research Corporation for Science Advancement, aimed at promoting research, dialog and community.

The team found that interactions in assigned conference sessions—at both in-person and virtual conferences—were a significant predictor of future collaborations.

In fact, participants who formed fruitful collaborations interacted with one another 63% more at in-person conferences than participants who did not form collaborations. And participants who interacted with others in small-group settings (two to four people) at in-person conferences were eight times more likely to form new collaborations than those who did not join small-group discussions.

"Today, science is conducted by teams, so the formation of new teams is especially important," Zajdela said. "Science isn't done by individuals anymore. It's more interdisciplinary and multi-institutional. We need these conferences because scientists can meet other researchers who they might never have met otherwise."

Initially, Zajdela and Abrams tracked patterns of interactions among hundreds of scientists during 12 multiday, in-person Scialog conferences over the span of five years, including room-level participation data. But when the COVID-19 pandemic hit, most conferences, including Scialogs, shifted to a virtual format.

"From a scientific perspective, this provided us with a rare natural experiment and the ability to make a direct comparison between virtual and in-person conferences," Zajdela said. "Before doing this study, we hypothesized that virtual conferences would be less effective at forming new collaborations among scientists. Instead, what we found was surprising."

After applying its mathematical model to six virtual Scialog conferences, the team found that virtual conferences were just as effective—if not more effective—at encouraging interactions and, thus, sparking collaborations. Scientists who formed collaborations at in-person conferences interacted 1.6 times more than those who did not form collaborations. But participants who formed collaborations at virtual conferences interacted two times more than those who did not.

"We interpret these results as coming from the fact that scientists did not have the same opportunities for informal interaction (during breaks or meals) in the virtual conferences as they did in the in-person conferences,"

The team found that interactions in assigned conference sessions—at both in-person and virtual conferences—were a significant predictor of future collaborations.

Zajdela said. "Therefore, the sessions they were assigned to were the only place that they could meet people to form teams with; hence the greater importance of interaction in these sessions for team formation."

Zajdela's presentation is titled "The Physics of Team Formation: Modeling the Catalysis of Collaboration at In-Person and Virtual Conferences," which is a part of the session "Physics of Social Interactions II."

Phys Org, 14 March 2022

https://phys.org

Do I or my child need a Japanese encephalitis vaccine?

2022-03-11

This week we heard two Australians have died from the mosquito-borne Japanese encephalitis virus. The virus has now been detected in four states.

Authorities are concerned we'll see more cases around the country and have earmarked extra funding to roll out vaccines to those at risk.

Who is recommended to have the vaccine depends on factors including their age, occupation and location. Here's what you need to know about accessing the vaccine in Australia, ahead of further announcements expected in coming days.

What is Japanese encephalitis?

Japanese encephalitis is caused by the Japanese encephalitis virus. It spreads through mosquito bites. It cannot be transmitted from human to human.

Most people will show no symptoms. However, 1% will develop swelling of the brain (encephalitis). Of those who have symptoms, up to 30% will die and a further 50% will have life-long neurological disability. The infection is particularly severe in the elderly or the young.

The virus had previously been found in Southeast Asia, Western Pacific regions, and in the Torres Strait.

However, because of its spread into new regions further south, last week Japanese encephalitis was designated a communicable disease of national significance.

Tell me more about the vaccines

The virus had previously been found in Southeast Asia, Western Pacific regions, and in the Torres Strait.

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Currently, seven Japanese encephalitis virus vaccines are licensed for use in humans globally. Two of these – Imojev and JEspect – are approved for use in Australia by the Therapeutic Goods Administration.

Imojev is approved for those from nine months of age and is given as a single dose. JEspect is approved for use from two months of age and is given as two doses, 28 days apart. JEspect can be given to pregnant women, if necessary.

The level of immunity from these vaccines varies. A single dose of Imojev can provide immunity for up to five years. Whereas JEspect requires two doses to provide immunity for two years, with some studies suggesting a third booster after 12 months provides longer protection.

These vaccinations come with some side effects. These include redness, pain and mild swelling at the vaccination site. Other side effects include headache, fatigue and muscle pains.

These vaccines vary in the way they are prepared. Also, different strains of the virus are used to make the different vaccines. This can ultimately affect how well they work to prevent disease if there is a change in the current circulating virus strain.

Who can get the vaccine?

Vaccination is currently recommended for high-risk groups, which currently includes:

- laboratory workers who work with the virus
- travellers who will spend one month or more in an endemic region
- people living or working in the outer islands of the Torres Strait.

Before the current spread of Japanese encephalitis you could get the vaccine at GP clinics specialising in travel medicine. It costs A$300-350, which includes a GP visit and the vaccine itself.

But with the spread of the virus in mainland Australia, the definition of high risk will likely change and the vaccine may be available to those high-risk groups via their GP or at work. At this stage we don't know if the vaccines would be free, but that will be confirmed in coming days.

For instance, piggery workers are among workers expected to be considered high risk and be offered the vaccine.

That's because Japanese encephalitis virus infects pigs (it has been detected in piggeries in NSW, Queensland, Victoria and South Australia).

The virus then enters the mosquito population when they bite pigs, which then later bite humans and spread it to us.

A national group of communicable disease, vaccine and virus experts is considering whether a wide vaccine rollout is needed and if so, how this might work.

National cabinet is also expected to discuss the issue and make further announcements shortly.

How can I protect myself, even without the vaccine?

There are currently no specific treatments for people with Japanese encephalitis. Symptoms are managed with supportive care, including fluids and pain relief.

Vaccination is one form of protection. However, the most useful protection comes from not being bitten by a mosquito in the first place.

The Conversation, 11 March 2022

https://theconversation.com

What is Pi Day? Why mathematicians and bakers unite to celebrate

2022-03-14

What do mathematicians and pie fans have in common? A love for March 14.

Monday marks Pi Day.

For math lovers, it's a chance to celebrate Pi, one of the most important numbers ever, representing the ratio of a circle's circumference to its diameter.

Although Pi is typically rounded up to 3.14, it can go on forever. According to Guinness World Records, the most accurate value for Pi is more than 62 trillion digits (62,831,853,071,796 to be precise). It was calculated last August by the University of Applied Sciences in Switzerland.

For those who don't enjoy math, you get pie. Cherry pie. Apple pie. Pizza pie. All the pies.

Whether you calculate it or eat it, Pi (and pie) bring joy to many. Here's how it all started.

Who knew math was so yummy?

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The history of Pi

Pi has been around for 4,000 years, used by ancient Babylonians to calculate the area of a circle by taking three times the square of its radius, according to the Exploratorium, a San Francisco-based museum.

Early calculations of Pi were based on measurement until the Greek mathematician Archimedes became the first to use an algorithmic approach, according to PiDay.org, a website created to encourage learning in STEM subjects.

The Pi symbol was introduced in 1706 by mathematician William Jones, but it wasn't made popular until Swiss mathematician Leonhard Euler used it in 1737.

The Pi symbol is the first letter of the Greek word, perimetros, which loosely translates to "circumference," says PiDay.org.

How did Pi Day start?

Former physicist Larry Shaw, who connected March 14 with 3.14, celebrated the first Pi Day at the Exploratorium with fruit pies and tea in 1988. The museum said Shaw led Pi Day parades there every year until his passing in 2017.

In 2009, the House of Representatives passed a resolution marking March 14 as National Pi Day.

March 14 is more than Pi

The date is significant in the world of science. Albert Einstein was born on this day in 1879. The Exploratorium said it added a celebration of Einstein's life as part of its Pi Day activities after Shaw's daughter, Sara, realized the coincidence.

March 14 also marks the death of renowned theoretical physicist Stephen Hawking, who passed away in 2018.

Why all the pizza and pie on Pi Day?

The first Pi Day celebration at the Exploratorium included a "pie feast" for museum staff, and ever since, people have been grabbing a slice to celebrate.

Of course, since pizza is sometimes referred to as pie, our tasty options for Pi Day are expanded.

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That's why many pizza chains and other businesses started offering Pi Day deals, which mostly consist of buying pizza or pies for $3.14.

Who knew math was so yummy?

Phys Org, 14 March 2022

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Technical Notes

MAR. 18, 2022

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

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Bisphenol A replacement chemicals, BPF and BPS, induce protumorigenic changes in human mammary gland organoid morphology and proteome

Organic UV Filters Induce Toll-like-Receptors and Related Signaling Pathways in Peripheral Blood Mononuclear Cells of Juvenile Loggerhead Sea Turtles (Caretta caretta)

The Association between ADHD and Environmental Chemicals-A Scoping Review

ENVIRONMENTAL RESEARCH

Covid-19-derived plastic debris contaminating marine ecosystem: Alert from a sea turtle

Potential trade-off between water consumption and water quality: life cycle assessment of nonaqueous solvent dyeing

PHARMACEUTICAL/TOXICOLOGY

A high-throughput assay for screening the abilities of per- and polyfluoroalkyl substances in inducing plasma kallikrein-like activity

Exposure to phthalates and female reproductive health: a literature review

OCCUPATIONAL

The Escalating Crisis of Health and Safety Law Enforcement in Great Britain: What Does Brexit Mean?

Job Exposure Matrix for Chrysotile Asbestos Fibre in the Asbestos Cement Manufacturing (ACM) Industry in Zimbabwe

Occupational External Exposure to Ionizing Radiation in Research-Associated Activities in Iran (2015-2020)