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CONTACT US

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

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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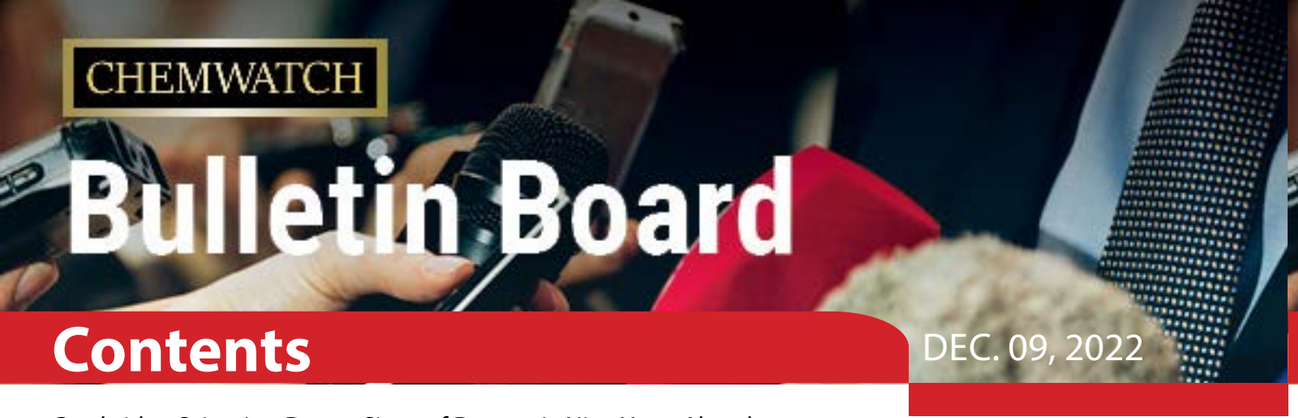

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ASIA PACIFIC

Inquiry into food security commences

2022-11-30

An inquiry into Australia's food security commenced on 26 October 2022.

The Australian Parliament's Agriculture Committee will examine ways to strengthen and safeguard food security in Australia, with a particular focus on local food production and the impact of supply chain disruptions on the cost and availability of food.

Submissions to the inquiry will be open until 9 December 2022. Further information, including the Terms of Reference, can be found on the Committee's website. The media release is available here.

Read More

Food Standards News, 30-11-22

https://mailchi.mp/3c81b4c0640d/food-standard-news-1300496?e=%5bUNIQID%5d#Website

New! AICIS risk-management recommendations register

2022-11-25

Our risk-management recommendations register is now available.

About the register and what will it will tell you

The register is a list of risk-management recommendations we've made about chemicals that we've assessed or evaluated.

Our assessments and evaluations:

- look at the potential risks to human health and the environment associated with the introduction (importation and manufacture) and use of industrial chemicals
- can include recommendations on proposed means for managing any risks we've identified

After we publish our assessments and evaluations, we refer our risk-management recommendations to the relevant 'prescribed body/bodies'.

Prescribed bodies include Australian standard-setting bodies and/or states and territories risk-management agencies.

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The register is part of our commitment to give industry, workers, the community and all stakeholders timely and easily accessible information about:

- recommendations we've made
- to whom we referred them
- the status of our recommendations

Read More

Australian Industrial Chemicals Introduction Scheme, 25-11-22

https://www.industrialchemicals.gov.au/news-and-notices/new-aicis-risk-management-recommendations-register

China Adopts Yellow River Protection Law

2022-11-30

In control areas along the mainstream and tributaries of the Yellow River, the new construction and expansion of chemical parks/projects will be prohibited. Heavy penalties will apply if there is any violation.

In the whole Yellow River basin, environmental risk assessment and control of toxic and hazardous chemicals will be implemented by authorities.

On October 30, 2022, the Yellow River Protection Law (hereinafter referred to as the Law) was adopted by the National People's Congress (NPC) Standing Committee, which targets key issues of the Yellow River basin*, e.g., water shortage, ecological fragility and flooding, etc. The Law is the second piece of legislation on a key river basin in China after the enactment of the Yangtze River Protection Law**. It will take effect on April 1, 2023.

Read More

Chemlinked, 30-11-22

https://chemical.chemlinked.com/news/chemical-news/china-adopts-yellow-river-protection-law

Version 2.0 of the Categorisation Guide released (November 2022)

2022-11-25

Today we announced some regulatory changes due to the amendment of the Industrial Chemicals (General) Rules 2019, or General Rules, relating

to introductions with a combined volume of 10 kg or less in a registration year.

As a result, we've updated the 'Guide to categorising your chemical importation and manufacture' (Categorisation Guide). The main changes to the Categorisation Guide are the addition of:

- introductions of 10 kg or less to Step 3 - Introductions that are in the reported category of the Categorisation Guide - including criteria that must be met
- a new page called 'Your obligations after categorisation' to give more clarity to introducers about their next steps after they've categorised their introduction

You can see all the changes we've made by viewing the version history on the cover page of the Categorisation Guide.

Read More

Australian Industrial Chemicals Introduction Scheme, 25-11-22

https://www.industrialchemicals.gov.au/news-and-notices/version-20-categorisation-guide-released-november-2022

AMERICA

EPA skips stricter aircraft pollution regs

2022-11-31

Have patience.

That, in essence, is the response of EPA officials to criticism that they are whiffing on an opportunity to strengthen commercial jet aircraft engine pollution regulations and benefit environmental justice communities.

The tension is on display in a newly published final rule aimed at syncing U.S. emissions standards for new engines with the guidelines of the International Civil Aviation Organization (ICAO), a U.N. agency responsible for air transport issues.

With a January 2023 deadline looming, however, EPA acknowledges the revised standards will have no immediate effect in curbing releases of harmful particulate matter and highlights their importance in keeping domestic engine manufacturers competitive in the global marketplace.

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"EPA has historically given significant weight to uniformity with international requirements as a factor in setting aircraft engine standards," the rule says. "The fact that most airplanes already meet the standards does not in itself mean that the standards are inappropriate, provided the agency has a reasonable basis after considering all the relevant factors."

But it adds that EPA views "regulation of aircraft PM emissions as a long-term process, with the potential for successive standards of increasing stringency."

In a follow-up to studies showing that many communities near airports have disproportionately high populations of people of color and low-income residents, the agency is also undertaking an analysis to more fully understand the resulting "human health or environmental effects."

An EPA spokesperson, noting that many agency employees are out Wednesday in advance of the Thanksgiving holiday, could not immediately address questions on the analysis's expected completion date or plans by EPA to explore stricter engine standards.

Particulates are linked to an array of cardiovascular and respiratory ills, including a higher risk of early death for people with preexisting conditions.

The final rule published Wednesday appears little changed from an earlier draft that came under fire at a February public hearing.

While President Joe Biden vowed to "usher in a clean energy revolution" and prioritize environmental justice concerns, "not only does EPA's proposed PM rule fail to meet those goals, it doesn't even take them seriously," said Scott Hochberg, an attorney with the Center for Biological Diversity, according to a transcript.

"For the safety of our communities and the environment, PM reductions from aircraft are needed," Bonnie Soriano, a branch chief with the California Air Resources Board, said later in the hearing. Aircraft are a major source of those emissions, Soriano said, adding that "EPA should stop outsourcing" its policies to ICAO.

Read More

Green Wire, 23-11-22

https://www.eenews.net/articles/epa-skips-stricter-aircraft-pollution-regs/

SEC Reporting Rules Are Year's Biggest Climate Finance Hurdle

2022-11-23

Upcoming SEC climate-disclosure rules will likely present a major challenge to public companies, according to climate watcher David Callaway. President Biden's recently released rules for federal contractors signal how the SEC rules might look, he says.

Now that COP27 in Egypt is over and the US midterm elections yielded a divided Congress, the next major event in the climate finance world will be the Securities and Exchange Commission's new rules on climate reporting for public companies. One clue as to what the rules will look like may have just come from the Biden administration.

Bankers and regulators don't expect SEC Chair Gary Gensler to release the new rules until early next year, after they were delayed indefinitely last month following an unprecedented comment period that drew more than 14,000 letters. The rules will almost immediately trigger litigation from companies, business groups, and Republican opposition, which will argue the agency is exceeding its authority to regulate Wall Street by trying to fight climate change.

"There are different interests at play here," David Atkin, chief executive of the Principles for Responsible Investment in London, a UN-supported organization, told me. "We think directionally they're heading toward the right place, though we think there is still some tweaking to be done."

Scope 3 Emissions

Tweaking may be understating it. At the heart of the debate is a controversy over the inclusion of specific data about greenhouse gas emissions from a company's supply chains, known as Scope 3 emissions. Scope 1 emissions, which are a company's direct emissions, and Scope 2, which are emissions produced from the energy it uses, are much easier to tally than Scope 3, which for large companies could involve hundreds of suppliers.

Scope 3 emissions are typically the majority of any large company's pollution footprint. Big companies such as HP, Ford Motor Co., and Unilever are already voluntarily working to reduce them, according to Ceres, a research network supporting sustainable capital markets. Many others argue it would be too hard to control the emissions of massive lists

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of suppliers and might even dilute the value of their climate reporting, especially if they are included in financial statements as the SEC proposed.

Read More

Bloomberg Law, 23-11-22

https://news.bloomberglaw.com/us-law-week/sec-reporting-rules-are-years-biggest-climate-finance-hurdle

Assuring that evolving air standards are met

2022-11-24

Breathe in. Breathe out. The purity of the air we breathe is an ever-changing target, as toxins are emitted into the environment, corporations test chemicals, and the environment degrades. Those of us living in Michigan depend not only on federal standards to protect our air quality, but on evolving state standards of industry and nature, and for agencies to stay current on all of changes and to provide permits and to communicate them to the appropriate parties in a timely fashion.

Michigan's Department of Environment, Great Lakes and Energy (EGLE) is gearing up for a productive 2023. After years of being criticized for underfunding the state agency charged with protecting the state's air, water, land and other natural resources, the state legislature on July 1, 2022, approved a bipartisan budget for the fiscal year that began October 1, 2022, slating $729 million for EGLE. That's a 31 percent increase over last year's budget, and the increased funding allows EGLE to hire 53 new full-time employees.

That's good news for EGLE's Air Quality Division (AQD), which has been allocated $4.4 million and the go-ahead to hire 15 employees within its ranks for air quality permitting. Among the many tasks and departments of AQD include emissions monitoring, modeling and reporting, enforcing compliance of state and federal air regulations as outlined within the Environmental Protection Agency's (EPA) Clean Air Act, lies a tiny group of four toxicologists who make up the Toxics Unit.

The Toxics Unit, assigned the task of regulating sources of air pollutants to protect human health, is charged with creating and updating heath-based screening levels of hundreds of chemicals which are utilized by thousands of businesses in the state that operate within the AQD's permits to install regulatory programs for the assessment of toxic air contaminant emissions. It is the Toxics Unit's task to maintain, update and monitor an ever-growing database of what is known as the List of Screening Levels.

Created in 1988, the List of Screening Levels now stands at 1,269 toxic air contaminants. The unit in 2021 added 26 new screening levels to the list as they relate to human health exposure risks.

The open-ended list is readily available on EGLE's website. Chemicals under review for consideration of altering screening levels are also up for public comment. In the early years of the screening program, memos describing the justification for the screening levels were only available upon request. While the public always had the ability to informally comment on the screening levels, as of December 2016, to provide further transparency, the division formalized the comment process and provides a 30-day formal public comment period on all health-based screening levels and their justifications.

Toxicologists develop screening levels by reviewing existing toxicology literature and evaluating health-based limits published by other environmental agencies to create screening levels which are the most appropriate and defensible values. The division prefers large human studies of sensitive toxicology endpoints over animal tests.

Read More

Downtown, 24-11-22

https://www.downtownpublications.com/single-post/assuring-that-evolving-air-standards-are-met

EUROPE

Spirit drinks: EU reference methods of analysis for ethyl alcohol of agricultural origin

2022-11-08

This act aims at extending the EU reference methods for the analysis of spirit drinks to the analysis of ethyl alcohol of agricultural origin, following the amendment of its definition and requirements in the spirit drinks regulation. At the same time, it aims at repealing the relevant legislation in force, which has become obsolete.

Having regard to the Treaty on the Functioning of the European Union, Having regard to Regulation (EU) 2019/787 of the European Parliament and of the Council of 17 April 2019 on the definition, description, presentation and labelling of spirit drinks, the use of the names of spirit drinks in the presentation and labelling of other foodstuffs, the protection

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of geographical indications for spirit drinks, the use of ethyl alcohol and distillates of agricultural origin in alcoholic beverages, and repealing Regulation (EC) No 110/20081 , and in particular Article 20, first paragraph, point (d), thereof, Whereas:

(1) The definition and requirements for ethyl alcohol of agricultural origin laid down in Article 5 of Regulation (EU) 2019/787 have been amended by Commission Delegated Regulation (EU) 2022/13032 among others to bring the maximum level of certain residues in line with the technical parameters currently used by the industry and by most laboratories of analysis.

(2) In that context, it is deemed necessary to amend Commission Regulation (EC) No 2870/20003 to extend the reference methods set out in the Annex thereto to the analysis of ethyl alcohol of agricultural origin.

(3) The alcoholic strength by volume of ethyl alcohol of agricultural origin should be established on the basis of the reference method set out in Chapter I of the Annex to Regulation (EC) No 2870/2000 as that is the established method currently used for the analysis of spirit drinks. For that purpose, it is appropriate to establish that ethyl alcohol of agricultural origin should be considered as a distillate whose alcoholic strength by volume is to be measured directly and not after distillation. Nonetheless, since automatic densimeters provide an erratic number when the injected alcohol is not clear, it is appropriate to provide that the sample should be distilled in that case.

Read More

European Commission, 08-11-22

https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13240-Spirit-drinks-EU-reference-methods-of-analysis-for-ethyl-alcohol-of-agricultural-origin_en

Reminder – upcoming GB active substance renewal submission deadlines

2022-11-24

Apply for active substance renewal by the deadlines to keep products on the GB market

Under the GB BPR, active substance approvals will expire unless a renewal application is submitted at least 550 days before their expiry date.

The 550-day deadlines are coming up for the following active substance/ product type combinations under GB BPR:

- (RS)-α-cyano-3phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) (CAS 52315-07-8 EC 257-842-9) in product type 8

  28 November 2023

- Carbon dioxide (CAS 124-38-9 EC 204-696-9) in product type 15

  28 November 2023

- 1-[[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]methyl]-1H-1,2,4-triazole (Propiconazole) (CAS 60207-90-1 EC 262-104-4) in product type 9

  28 November 2023

Any person, company or taskforce/consortium can support an active substance/product type combination for renewal – it doesn't have to be the original supporter

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HSE, 24-11-22

https://www.hse.gov.uk/biocides/gb-article-95-transition/action-for-article-95-suppliers.htm

EUON list of Nanomaterials Currently on the EU Market updated

2022-11-16

The European Union Observatory for Nanomaterials' (EUON) list of Nanomaterials Currently on the EU Market has been updated.

The following substances were added:

1. Calcium bis[2-[(2-hydroxynaphthyl)azo]naphthalenesulphonate]
2. Barium 3-hydroxy-4-[(4-methyl-2-sulphonatophenyl)azo]-2-naphthoate

Read More

Yordas Hive, 16-11-22

https://www.yordashive.com/news/hp8bseg753a8l79p5z6admkdslwwkb

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Re-evaluation of neohesperidine dihydrochalcone (E 959) as a food additive

2022-11-17

The present opinion deals with the re-evaluation of neohesperidine dihydrochalcone (E 959) when used as a food additive. It is obtained by catalytic hydrogenation of a flavanone – neohesperidine – which is naturally occurring and thus isolated by alcohol extraction in bitter oranges (Citrus aurantium). Based on in vivo data in rat, neohesperidine dihydrochalcone is likely to be absorbed, also in humans, and to become systemically available. It does not raise a concern regarding genotoxicity. The toxicity data set consisted of studies on subchronic and prenatal developmental toxicity. No human studies were available. The data set was considered sufficient to derive a new acceptable daily intake (ADI). Based on the weight of evidence (WoE) analysis, the Panel considered unlikely that neohesperidine dihydrochalcone would lead to adverse effects on health in animals in the dose ranges tested. The Panel also considered that a carcinogenicity study was not warranted and that the lack of human data did not affect the overall confidence in the body of evidence. The Panel derived an ADI of 20 mg/kg bodyweight (bw) per day based on a no observed adverse effect level (NOAEL) of 4,000 mg/kg bw per day from a 13-week study in rat, applying the standard default factors of 100 for inter- and intraspecies differences and of 2 for extrapolation from subchronic to chronic exposure. For the refined brand-loyal exposure assessment scenario, considered to be the most appropriate for the risk assessment, the exposure estimates at the mean ranged from <0.01 to 0.09 mg/kg bw per day and at the 95th percentile (P95) from 0.01 to 0.24 mg/kg bw per day. Considering the derived ADI of 20 mg/kg bw per day, the exposure estimates were below the reference value in all age groups. Therefore, the Panel concluded that dietary exposure to the food additive neohesperidine dihydrochalcone (E 959) at the reported uses and use levels would not raise a safety concern.

Read More

EFSA, 17-11-22

https://www.efsa.europa.eu/en/efsajournal/pub/7595

SCIP database now open to submissions from EEA countries

2022-11-09

The obligation to submit notifications to ECHA's database of substances of concern in products (SCIP) has been extended to also cover companies supplying articles in the European Economic Area (EEA).

From 7 November 2022, companies from Iceland, Liechtenstein and Norway can start submitting their SCIP notifications.

Read More

ECHA, 09-11-22

https://echa.europa.eu/scip

ECHA has launched public consultation on MCCP restriction proposal

2022-11-17

The proposed restriction aims at "assessing and addressing the potential risks to human health or the environment arising from the manufacture, use or placing on the market of 'MCCP' (defined in the Candidate List as UVCB substances consisting of more than or equal to 80 % linear chloroalkanes with carbon chain lengths within the range from C14 to C17) and other substances containing the same 'MCCP' constituents having PBT and/or vPvB properties"2.

The substances in the scope of the proposed restriction are UVCB containing CA:C14-17 constituents3 (congeners) with PBT and/or vPvB properties: 69 substances are identified that may fall within the scope of the proposed restriction (a non- exhaustive list is available in Appendix B.1.2. to the Annex XV restriction proposal, and at the end of this info note). Considering the risks associated to CA:C14-17 with PBT and/or vPvB properties, the availability of alternatives and that the proposed restriction could also be useful for the on-going discussions in relation to the POP listing of these substances under the Stockholm Convention, the Dossier Submitter proposes two restriction entries:

- Option A: a ban on manufacturing and placing on the market substances, mixtures and articles containing more than 0.1% of CA:C14-17 with PBT and/or vPvB properties. The ban would apply after a two-year transition period.

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- Option B: a ban on solely placing on the market substances, mixtures and articles containing more than 0.1% of CA:C14-17 with PBT and/or vPvB properties. The ban would apply after a two-year transition period, except for metalworking fluids where either a longer transition period (7 years) or a derogation could be considered depending on the information submitted during the Annex XV consultation.

Read More

ECHA, 17-11-22

https://echa.europa.eu/documents/10162/2beed524-ab79-06eb-5101-15112b042f51

Janet's Corner

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Health and Safety

2022-12-09

twitter.com/ErrantScience/status/1590684640414777346

Hazard Alert

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1,1,2-Trichloroethane

2022-12-09

1,1,2-Trichloroethane, or 1,1,2-TCE, is an organochloride solvent with the molecular formula $C_2H_3Cl_3$. It is a colourless, sweet-smelling liquid that does not dissolve in water, but is soluble in most organic solvents. [1] 1,1,2-Trichloroethane does not burn easily and boils at a higher temperature than water. [2]

USES [3]

1,1,2-Trichloroethane is used as a chemical intermediate and a solvent. 1,1,2-Trichloroethane is primarily used as a chemical intermediate in the production of 1,1-dichloroethene. It is also used as a solvent for chlorinated rubbers, fats, oils, waxes, and resins.

IN THE ENVIRONMENT [4]

1,1,2-Trichloroethane will exist as a gas if released to the atmosphere. It dissolves only slightly when mixed with water. It also evaporates from soil and water when they are exposed to the air. In the air when it reacts into other chemicals, it takes a long time. It has moderate acute (short-term) toxicity on aquatic life. It has moderate chronic (long-term) toxicity to aquatic life. Chronic and acute effects on plants, birds or land animals have not been determined. 1,1,2-Trichloroethane does not bioaccumulate. Industrial emissions of 1,1,2-Trichloroethane can produce elevated concentrations in the atmosphere around the source. Since it takes a long time to breakdown in the air it is likely to spread far from where it is used. Most of the releases are to the air, releases to the soil and water quickly evaporate to the air. Since it does not bind to soil well, 1,1,2-Trichloroethane that makes its way into the ground, and does not evaporate may move through the ground and enter groundwater.

SOURCES OF EMISSION & ROUTES OF EXPOSURE

Sources of Emission [4]

- Industry sources: The primary sources of 1,1,2-Trichloroethane emissions are the industries that manufacture it or use it in production. Some of the industries that use it in production are the chemical industry, rubber manufacturers, heavy equipment manufacturing, the timber products industry, the plastics and synthetics industries and laundries. These are emissions to the air unless there is a spill.

1,1,2-Trichloroethane, or 1,1,2-TCE, is an organochloride solvent with the molecular formula C2H3Cl3.

- Diffuse sources: Other possible emitters of 1,1,2-Trichloroethane are the electronics industry (solvent use) and manufacturers of fabricated metal parts.
- Natural sources: 1,1,2-Trichloroethane does not occur naturally in the environment.
- Transport sources: No mobile sources.
- Consumer products: Aerosol paint concentrates.

Routes of Exposure [2]

1,1,2-Trichloroethane can enter the body when a person breathes air contaminated with it, or when a person drinks water containing this compound. It can also enter the body through the skin. After it enters the body, it is carried by the blood to organs and tissues such as the liver, kidney, brain, heart, spleen, and fat.

Experiments in which animals were given 1,1,2- trichloroethane by mouth have shown that most 1,1,2-trichloroethane leaves the body unchanged in the breath and as other substances that it was changed into in the urine in about 1 day. Very little stays in the body more than 2 days.

HEALTH EFFECTS

Acute Effects [3]

1,1,2-Trichloroethane is a potent central nervous system depressant. In high concentrations, in air, with closed or poorly ventilated areas, single exposures to 1,1,2-Trichloroethane may cause central nervous system effects leading to dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking or walking, and possibly unconsciousness, coma and death. It is a narcotic at high levels. Exposures to vapour concentrations near 2,000 parts per million for five minutes cause central nervous system depression and the effect of being anaesthetised. Adverse liver and kidney effects have are possible from high exposures or from long-term exposure to 1,1,2-Trichloroethane. It will also defat the skin causing irritation and dryness. Other effects may include headache, tremor, dizziness, and irritation of the eyes, nose and throat.

Chronic Effects [4]

- No information is available on the chronic effects of 1,1,2-trichloroethane in humans from inhalation or oral exposure. Animal studies have not observed adverse effects from chronic inhalation exposure to 1,1,2-trichloroethane. Effects on the liver and

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immune system have been noted in chronic oral studies. EPA has not established a Reference Concentration (RfC) for 1,1,2-trichloroethane.

- The California Environmental Protection Agency (CalEPA) has established a chronic reference exposure level of 0.4 milligrams per cubic metre (mg/m^3) based on liver effects in rats.
- The Reference Dose (RfD) for 1,1,2-trichloroethane is 0.004 milligrams per kilogram body weight per day (mg/kg/d) based on clinical serum chemistry in mice.

Reproductive/Developmental Effects [4]

- No information is available regarding developmental or reproductive effects of 1,1,2-trichloroethane in humans from inhalation or oral exposure.
- Animal studies have not reported developmental or reproductive effects from oral exposure to 1,1,2-trichloroethane.

Cancer Risk [4]

- No studies are available regarding cancer in humans from inhalation or oral exposure.
- A study by the National Toxicology Program reported liver tumours and adrenal tumours in mice, but no tumours in rats from exposure to 1,1,2-trichloroethane by gavage.
- EPA has classified 1,1,2-trichloroethane as a Group C, possible human carcinogen.

SAFETY [5]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.
- Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- Inhalation: Allow the victim to rest in a well-ventilated area. Seek immediate medical attention.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
- Ingestion: Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Exposure Controls & Personal Protection

Engineering Controls

- Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.
- Ensure that eyewash stations and safety showers are proximal to the workstation location.

Personal Protective Equipment

The following personal protective equipment is recommended when handling 1,1,2-trichloroethane:

- Splash goggles
- Lab coat
- Gloves

Personal Protection in Case of a Large Spill:

- Splash goggles
- Full suit
- Boots
- Gloves
- Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

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REGULATION [2,4,6]

United States

OSHA: Occupational Safety & Health Administration has established the following Permissible Exposure Limits (PEL):

- General Industry: 29 CFR 1910.1000 Z-1 Table -- 10 ppm, 45 mg/m^3 TWA; Skin
- Construction Industry: 29 CFR 1926.55 Appendix A -- 10 ppm, 45 mg/m^3 TWA; Skin
- Maritime: 29 CFR 1915.1000 Table Z-Shipyards -- 10 ppm, 45 mg/m^3 TWA; Skin

ACGIH: American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for 1,1,2-trichloroethane of 10 ppm, 55 mg/m^3 TWA for an 8-hour workday in a 40-hour workweek.

NIOSH: National Institute for Occupational Safety and Health has established a Recommended Exposure Limit (REL) for 1,1,2-trichloroethane of 10 ppm, 45 mg/m^3 TWA;

EPA: The Environmental Protection Agency has set a limit of 0.005 milligrams of 1,1,2-trichloroethane per litre of drinking water (0.005 mg/L). Discharges, spills, or accidental releases of 100 pounds or more of 1,1,2-trichloroethane must be reported to the EPA.

Australia

Safe Work Australia: Safe Work Australia has established a Time Weighted Average (TWA) concentration for 1,1,2-trichloroethane of 10 parts per million over an eight-hour work shift.

REFERENCES

1. http://en.wikipedia.org/wiki/1,1,2-Trichloroethane
2. http://www.atsdr.cdc.gov/phs/phs.asp?id=794&tid=155
3. http://www.epa.gov/ttn/atw/hlthef/tri-etha.html
4. http://www.npi.gov.au/resource/112-trichloroethane
5. http://www.sciencelab.com/msds.php?msdsId=9927632
6. https://www.osha.gov/dts/chemicalsampling/data/CH_272900.html

New CRISPR gene-editing system can "drag-and-drop" DNA in bulk

2022-11-24

A new technique has been added to the CRISPR gene-editing toolbox. Known as PASTE, the system uses virus enzymes to "drag-and-drop" large sections of DNA into a genome, which could help treat a range of genetic diseases.

The CRISPR system originated in bacteria, which used it as a defense mechanism against viruses that prey on them. Essentially, if a bacterium survived a viral infection, it would use CRISPR enzymes to snip out a small segment of the virus DNA, and use that to remind itself how to fight off future infections of that virus.

Over the past few decades, scientists adapted this system into a powerful tool for genetic engineering. The CRISPR system consists of an enzyme, usually one called Cas9, which cuts DNA, and a short RNA sequence that guides the system to make this cut in the right section of the genome. This can be used to snip out problematic genes, such as those that cause disease, and can substitute them with other, more beneficial genes. The problem is that this process involves breaking both strands of DNA, which can be difficult for the cell to patch back up as intended, leading to unintended alterations and higher risks of cancer in edited cells.

So MIT researchers set out to develop a new version of the tool that was more gentle on the genome. Rather than the "cut-and-paste" method of existing CRISPR-Cas9, the team describes the new method as more of a "drag-and-drop" system. PASTE, which stands for Programmable Addition via Site-specific Targeting Elements, still uses a Cas9 enzyme to cut DNA in a location specified by guide RNA, but the difference is that the new system cuts one strand and then the other, rather than both at once.

Insertion of the new genes is handled by enzymes called serine integrases, which are used by viruses to infect bacteria and insert their DNA into the target's genome – ironic, given CRISPR's origins as bacteria's defense against these exact attacks. These integrases naturally seek out specific sequences in the target genome, so after the PASTE system makes its gentle cut it inserts the small "landing site" sequence that the integrases are looking for. Finally, the integrase inserts its DNA payload into the genome at that site.

In a series of tests the team put the PASTE system to work in human liver cells, T cells and lymphoblasts, inserting 13 different genes into nine locations in the genome. The success rate was up to 60%, and generated

PASTE is a new variation on the CRISPR gene-editing system that should be more gentle on the genome.

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very few errors at the site of insertion. Tests in mice with "humanized" livers only worked in about 2.5% of cells, however.

Not only is this technique more gentle and potentially safer, but the team says it was able to insert huge amounts of DNA at once – up to 36,000 base pairs in tests. This could make it particularly useful for replacing defective genes such as those that cause cystic fibrosis or Huntington's disease.

"It's a new genetic way of potentially targeting these really hard-to-treat diseases," said Omar Abudayyeh, senior author of the study. "We wanted to work toward what gene therapy was supposed to do at its original inception, which is to replace genes, not just correct individual mutations."

While there's still plenty of work left to improve PASTE before it could be put to work treating these diseases, there's no shortage of other gentle variations on CRISPR in development. That includes CRISPR-Combo, MAGESTIC, RLR, and systems using bacteriophages or jumping genes.

The new research was published in the journal Nature Biotechnology.

New Atlas, 24 November 2022

https://newatlas.com

Cambridge Scientists Detect Signs of Dementia Nine Years Ahead of Diagnosis

2022-11-27

Researchers from the University of Cambridge have shown that it is possible to identify indicators of brain impairment in individuals up to nine years before they are given a dementia-related disease diagnosis.

The researchers examined data from the UK Biobank and discovered impairment in a number of areas, including problem-solving and numerical recall, across a variety of conditions. The findings were reported in a study that was recently published in Alzheimer's & Dementia: The Journal of the Alzheimer's Association.

The results suggest that in the future, at-risk individuals may be tested to help determine which ones may benefit from interventions to lower their chance of developing one of the conditions or to help identify people appropriate for enrollment in clinical trials for new treatments.

For dementia and other neurodegenerative diseases like Parkinson's disease, there are currently very few effective treatments available. This is

The study found that cognitive changes could appear years before diagnoses of neurodegenerative diseases.

due in part to the fact that these conditions are often only identified until symptoms appear, even though the underlying neurodegeneration may have started years or even decades before. This means that it could already be too late to change the course of the disease by the time people enroll in clinical trials.

Until now, it has been unclear whether it might be possible to detect changes in brain function before the onset of symptoms. To help answer this question, researchers at the University of Cambridge and Cambridge University Hospitals NHS Foundation Trust turned to UK Biobank, a biomedical database and research resource containing anonymized genetic, lifestyle, and health information from half a million UK participants aged 40-69.

As well as collecting information on participants' health and disease diagnoses, UK Biobank collected data from a battery of tests including problem-solving, memory, reaction times, and grip strength, as well as data on weight loss and gain and on the number of falls. This allowed them to look back to see whether any signs were present at baseline – that is, when measurements were first collected from participants (between five and nine years prior to diagnosis).

People who went on to develop Alzheimer's disease scored more poorly compared to healthy individuals when it came to problem-solving tasks, reaction times, remembering lists of numbers, prospective memory (our ability to remember to do something later on), and pair matching. This was also the case for people who developed a rarer form of dementia known as frontotemporal dementia.

People who went on to develop Alzheimer's were more likely than healthy adults to have had a fall in the previous 12 months. Those patients who went on to develop a rare neurological condition known as progressive supranuclear palsy (PSP), which affects balance, were more than twice as likely as healthy individuals to have had a fall.

For every condition studied – including Parkinson's disease and dementia with Lewy bodies – patients reported poorer overall health at baseline.

First author Nol Swaddiwudhipong, a junior doctor at the University of Cambridge, said: "When we looked back at patients' histories, it became clear that they were showing some cognitive impairment several years before their symptoms became obvious enough to prompt a diagnosis. The impairments were often subtle but across a number of aspects of cognition. This is a step towards us being able to screen people who are at

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greatest risk – for example, people over 50 or those who have high blood pressure or do not do enough exercise – and intervene at an earlier stage to help them reduce their risk."

Senior author Dr. Tim Rittman from the Department of Clinical Neurosciences at the University of Cambridge added: "People should not be unduly worried if, for example, they are not good at recalling numbers. Even some healthy individuals will naturally score better or worse than their peers. But we would encourage anyone who has any concerns or notices that their memory or recall is getting worse to speak to their GP."

Dr. Rittman said the findings could also help identify people who can participate in clinical trials for potential new treatments. "The problem with clinical trials is that by necessity they often recruit patients with a diagnosis, but we know that by this point they are already some way down the road and their condition cannot be stopped. If we can find these individuals early enough, we'll have a better chance of seeing if the drugs are effective."

Sci Tech Daily, 27 November 2022

https://scitechdaily.com

Disease-resistant super corals can save vulnerable reefs

2022-11-27

Coral reefs are in trouble. Physical destruction from dredging and coastal development, pollution, climate change, and ocean acidification have all contributed to the decline of coral reefs around the world, according to the Environmental Protection Agency.

Despite these challenges, corals have shown some signs of hope and different genes in theses resilient animals can potentially protect one another from diseases. A new study published this week in the journal Scientific Reports finds that disease-resistant corals can help "rescue" corals that are more vulnerable to disease, under the right living arrangement

A team from the University of California, Davis, the University of Florida, and the University of South Florida monitored a disease outbreak at a coral nursery at Little Cayman in the Caribbean. They found that corals of the same genetic makeup, or genotype, grown together are often more vulnerable to disease than the ones that grow among a mixture of different genotypes.

The process is similar to how herd immunity from vaccinations protects human populations.

"We saw that some corals were more resistant to disease just by being around other corals that were particularly resistant," said lead author Anya Brown, an assistant professor at the UC Davis Bodega Marine Laboratory, in a statement. "Proximity to these resistant genotypes helped buffer the susceptible corals from the effects of the disease."

The study also found that some of the more vulnerable corals can be "rescued" and helped along by resistant genotypes.

In 2019, an outbreak of white band disease spread through the Central Caribbean Marine Institute's coral nursery in Little Cayman. White band disease is a devastating bacterial disease that can completely destroy coral tissue in Caribbean staghorn coral (A. cervicornis) as well as elkhorn coral (Acropora palmata). The nonprofit organization worked with the study's academic authors to monitor the nursery's population of endangered A. cervicornis.

Coral fragments in the nursery were attached to plastic PVC frames before the outbreak. Coral from a single donor colony was housed in some frames, while others had corals from multiple donor colonies with a mixture of genotypes.

The team tracked the presence of the disease in 650 fragments of coral for five months and found that the corals living on the frames with a variety of genotypes were "substantially" more resistant to white band disease.

These stronger disease-resistant coral can help protect the more vulnerable ones similar to how mass vaccination works to protect groups of humans. Vaccinated people who are resistant to a specific disease create a barrier that weakens the disease's ability to move among the population and onto the next susceptible person. This is sometimes called herd immunity.

The importance of genetic diversity for disease resistance is also seen in farming. Monocrops, or where the same crop is planted in the same place every year, tend to be more susceptible to disease than diverse systems where the crops are more mixed.

This study suggests a similar dynamic is at play among the ocean's coral reefs and provides some evidence that genetic diversity can help reduce disease transmission among corals. It also demonstrates the importance of considering how corals are arranged in nurseries and reef restoration projects to prevent the spread of diseases like white band disease.

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"I hope people working with coral nurseries use this as a springboard to see how this influences the spread of disease," Brown said. "Nurseries that intentionally arrange corals with mixtures of genotypes can help corals vulnerable to disease thrive. This can help build coral resilience by repopulating reefs with a diverse genetic mixture of corals."

Popular Science, 27 November 2022

https://popsci.com

Demonstrating the micro power of hydrogen

2022-11-28

A small coastal town 820km north of Perth has the attention of the country as it trials Australia's first renewable hydrogen microgrid.

The microgrid, believed to be one of the first of its kind worldwide, this month began producing hydrogen in the community of Denham.

When it hits full swing, which is expected in early 2023, the $9.3 million Denham Hydrogen Demonstration Plant is expected to provide enough power for about 100 homes – or 20% of Denham's small population.

"Once fully operational, the plant will show how renewable hydrogen can be used to replace diesel and other fossil fuels to propel WA to net zero emissions by 2050," says Western Australia's Hydrogen Industry Minister Alannah MacTiernan.

"This project is the first step towards rolling out renewable hydrogen domestically – and has helped us build critical skills and understanding to move us along as a producer and user of renewable hydrogen."

The bulk of the Denham project – $5.7 million – has been funded by the WA Government, with a further $1 million through the WA Renewable Hydrogen Fund and $2.6 million from the Australian Renewable Energy Agency (ARENA).

Horizon Power and Hybrid Systems Australia are delivering the project that includes a 704kW solar farm, a 348kW hydrogen electrolyser, and a 100kW hydrogen fuel cell as an alternative to diesel generators. It has been built at the site of the town's existing power station.

The plant was opened in November and testing is now underway on the integration of the hydrogen, solar, battery and diesel components of the microgrid.

As the hydrogen energy revolution gathers pace, Australia is seeing more pilot projects getting off the ground, including a national first in the small town of Denham in Western Australia.

Horizon Power says the project should offset 140,000 litres of diesel a year. And, the company says, other remote diesel microgrids might follow the same path after 2025.

"It is very exciting to be officially opening a project that is leading the country in the demonstration of hydrogen as a base load fuel source," Horizon Power Chief Executive Officer Stephanie Unwin says.

"Together, with the State and Federal Governments, we are working towards the transition to clean, green energy and providing valuable learnings which could support the commercialisation of renewable hydrogen power generation.

"I would also like to thank the people of Denham, in particular the Shire of Shark Bay, for supporting this work – it has definitely put the town on the map in terms of Western Australia's decarbonisation journey to net zero by 2050."

WA's Energy Minister Bill Johnston says the Denham Hydrogen Demonstration Plant would help in Western Australia's aim to become a "hydrogen powerhouse".

"This project is the first step towards rolling out renewable hydrogen domestically – and has helped us build critical skills and understanding to move us along as a producer and user of renewable hydrogen," Johnston says.

Hybrid Systems Australia's executive director Mike Hall says the system aims to demonstrate the efficiency of the hydrogen equipment, the ramp rate of hydrogen, and the efficiency and storage capability of hydrogen fuel cells compared to batteries.

"As an industry-first, this project has presented some really interesting opportunities for us to grow our capabilities in the green hydrogen project delivery space," Hall says. "It's still a budding industry in Australia, so we really had to start at the beginning, from designing a system based on first principle thinking to navigating both existing and newly developing industry regulations and licensing designed for different applications.

"We've worked closely with Horizon Power and regulators to get the process right, and it's been a very dynamic project, but we looked at any challenges as growth opportunities, and in doing so, we've been able to see things through fresh eyes.

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"Different solutions have presented themselves along the way. It's made us more agile in this rapidly evolving space and, ultimately, better at what we do. It's been an exciting journey and one that we're really proud to have been a part of."

Shire of Shark Bay Council president Cr Cheryl Cowell says Denham could become a zero-emission community.

She says the council agreed early in the proposal to lease 20 hectares of land for the project. Excess energy from the solar panels will feed back into the grid.

"A benefit of the 'green hydrogen to electricity' supply chain is that storage of hydrogen ensures power 24/7," Cowell says.

"The capability of hydrogen power as a renewable energy source is being tested in Shark Bay to prove the reliability of a hydrogen powerplant to provide an opportunity to expand and supply full power requirements for Denham in the future."

She says Horizon wants to eventually replace Denham's diesel generators with renewable energy, with a goal to have no new diesel power generation from 2025.

"The Denham trial is important, as it may solve the problem of transporting power long distances across the State. The lower cost of photovoltaics means that megawatts of power can be supplied to customers, a much less costly exercise," Cowell says.

"We are really pleased to have been chosen to be the first regional town in WA to have a trial hydrogen plant established. It is proposed that 85% of Denham's power will come from renewables by 2025."

The trial goes hand-in-hand, Cowell says, with the community's appreciation of living surrounded by WA's first inscribed UNESCO World Heritage Area.

Cosmos, 28 November 2022

https://cosmosmagazine.com

Second death linked to potential antibody treatment for Alzheimer's disease

2022-11-27

A 65-year-old woman who was receiving a promising experimental treatment to slow the cognitive decline caused by her early Alzheimer's disease recently died from a massive brain hemorrhage that some researchers link to the drug. The clinical trial death, described in an unpublished case report Science has obtained, is the second thought to be associated with the antibody called lecanemab. The newly disclosed fatality intensifies questions about its safety and how widely lecanemab should be prescribed if ultimately approved by regulators.

The woman, who received infusions of the antibody as part of the trial, suffered a stroke and a type of swelling and bleeding previously seen with such antibodies, which bind to and remove forms of amyloid-beta, a protein widely theorized to cause Alzheimer's. After the stroke was diagnosed in an emergency room at Northwestern University Medical Center in Chicago, she was given a common intervention, the powerful blood-clot busting medication tissue plasminogen activator (tPA). Substantial bleeding throughout her brain's outer layer immediately followed, and the woman died a few days later, according to the case report.

Rudolph Castellani, a Northwestern neuropathologist who studies Alzheimer's and conducted an autopsy at the request of the patient's husband, called the case "very dramatic." The report, co-authored by Castellani, concluded that the woman, like the other person whose death was linked to lecanemab, had amyloid deposits surrounding many of her brain's blood vessels. This pre-existing condition, found in both Alzheimer's patients and to a lesser degree in the general population, frequently goes undetected other than by autopsy. It likely contributed to her brain hemorrhage after biweekly infusions of lecanemab inflamed and weakened the blood vessels. The vessels apparently burst when exposed to tPA—known to cause brain bleeds even in some conventional stroke cases.

"It was a one-two punch," Castellani says. "There's zero doubt in my mind that this is a treatment-caused illness and death. If the patient hadn't been on lecanemab she would be alive today." (Castellani says his comments reflect personal views and were not reviewed or approved by Northwestern. The patient's husband told Science he authorized Castellani to speak publicly about his wife's case. Science agreed to withhold both names to protect the family's privacy.)

Woman's brain hemorrhage while receiving Eisai's widely heralded lecanemab heightens concerns overs its safety.

Castellani, his co-authors, and other researchers say the newly disclosed death suggests that tPA and perhaps other, less potent blood thinners pose safety considerations for Alzheimer's patients receiving the antiamyloid antibody drugs, including lecanemab. The 30-page consent form for trial participants, obtained by Science, carries this warning about blood thinners: "You may continue with these medications, but you and the investigator should discuss the risk of bleeding since medications which prevent clots and [lecanemab] are both associated with a slight risk of bleeding in the brain." It does not address tPA directly.

The woman's husband says the events surrounding her death were fully disclosed to Great Lakes Clinical Trials, the Chicago-based contract research organization that administered lecanemab to his wife as part of the antibody's international, multicenter study. He attended a postmortem meeting with Great Lakes principal investigator and psychiatrist Jeffrey Ross, and a Northwestern physician who had participated in his wife's stroke care. According to the husband, Ross said during the meeting that he had shared details of the case with Eisai Co., the Japanese company that originally developed lecanemab with the Swedish firm BioArctic and sponsored the trial with its U.S. biotech partner Biogen. Ross did not respond to requests for comment.

Eisai declined to comment on the woman's case, including whether it knew about the death. "All the available safety information indicates that lecanemab therapy is not associated with an increased risk of death overall or from any specific cause," the company said in a statement to Science. It also declined to describe any other deaths in the woman's trial, citing the need to protect the privacy of participants, although it said there was no greater frequency of deaths among lecanemab-treated people in an earlier, smaller trial that had a placebo group. Any safety information is reported to regulators and the trial's principal investigators, Eisai's statement noted.

This week, Eisai is scheduled to provide the first detailed account of the phase 3 trial, known as Clarity AD, which enrolled about 1800 people with signs of early Alzheimer's disease. Outside scientists have been eager to scrutinize the data to assess whether the modest benefits announced in September in a brief press release—people on lecanemab had less amyloid in the brain and 27% less cognitive decline than participants who

received a placebo over an 18-month period—hold up and outweigh any safety concerns.

If approved, lecanemab would be the second antiamyloid drug to reach the clinic. Aducanumab, a recently approved drug for Alzheimer's disease also from Eisai and Biogen, is now on the market as Aduhelm. But many Alzheimer's researchers question the evidence that aducanumab works and were surprised it received U.S. Food and Drug Administration (FDA) approval.

Now some urge caution about its potential successor. "[Regulators] should take this case report seriously into account, because we're talking about significant side effects," says Andreas Charidimou, a neuroscientist at Boston University who examined the report on the woman's death for Science. "When there's so many unknowns it's better to be more conservative."

"Her body was on fire"

When speaking to Science last week, the dead woman's spouse was at times overcome by emotion as he described a shattering and chaotic scene after his wife entered the emergency department with stroke symptoms. He informed the doctors about the lecanemab trial and contacted Great Lakes, which provided a web link to information about the antibody. After the attending physician reviewed the website, the care team proposed infusing tPA, describing its risks as relatively small.

"As soon as they put it in her, it was like her body was on fire. She was screaming, and it took like eight people to hold her down," the husband says. "It was horrific. Everybody's running in and [asking] 'What the hell is going on?'" His wife was sedated and moved into intensive care, he adds. A priest came to deliver the "Anointing of the Sick" prayer.

Soon after, the husband says, his wife suffered a series of seizures and was placed on a ventilator. A few days later, the family approved disconnecting the device, and she died. Her doctors told him they had never before seen such massive bleeding under those circumstances, and that they wanted to write up the details of the case for a medical journal.

Lecanemab targets a soluble, "protofibril" version of amyloid-beta, and also binds—albeit more weakly—to the extracellular amyloid deposits known as plaques that are a hallmark of Alzheimer's disease. Other antibodies, including Aduhelm, bind to those plaques more strongly. Many physicians

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and Alzheimer's experts already advise against combining Aduhelm and blood thinners.

STAT recently reported that a man in his late 80s in lecanemab's phase 3 trial died of a brain hemorrhage linked to possible interaction between the experimental antibody and the blood thinner apixaban, sold under the name Eliquis. Doctors commonly prescribe the drug for atrial fibrillation—an irregular heart beat that can lead to stroke or heart failure. According to STAT, Eisai conceded in adverse event reports for the trial that its drug could have played a part in the fatal brain hemorrhage. (Such reports, submitted to FDA by family members, doctors, or others, are not regarded as proof that a tested therapy caused the event.) But the company later called the death unrelated and STAT said the case remains under investigation.

The woman who died after receiving tPA for her stroke had remained physically active throughout the lecanemab trial. She had retired about a year ago from a professional job that required sophisticated communication and analytic skills, but she had maintained civic involvement.

During the 18-month core trial, the woman might have received either the antibody or the placebo. But there was no question that she was given the antibody during the month preceding her death as part of an open-label trial extension, in which participants who want to take the experimental medication can do so.

Several physicians and researchers not involved in the trial or the woman's care reviewed the case report at Science's request and concurred with its findings that lecanemab likely contributed to her death. They said the woman probably received the placebo during the first part of the trial, because the inflammation seen in her blood vessels typically occurs within the first weeks of treatment with antiamyloid antibodies. Her husband agrees, recalling that during the core trial, she did not develop the headaches that she experienced after each infusion of the drug during the trial extension.

In its statement, Eisai said, "It can be difficult to determine what contributed to the death in any given patient, in particular when they are elderly, have multiple medical problems and may have recently received a concomitant treatment or intervention for an acute condition."

James Nicoll, a neuropathologist at the University of Southampton and a Biogen consultant, was among those asked to review the report. He

says although no single case provides proof of a harmful side effect, this death exposed "a very legitimate concern." Nicoll called the combined use of lecanemab and blood thinners "something you would want to keep a close eye on" should the antibody achieve approval and wide use.

What will FDA decide?

Eisai and Biogen made headlines in September when they announced that lecanemab had more clearly slowed cognitive decline in people with early Alzheimer's than any previous amyloid-targeted therapy. The conclusion was based on a standardized clinical measure of dementia that draws on observations of memory, judgment, personal care, and other factors by patients, family members, caregivers, and health professionals. But clinicians disagreed about whether the modest slowing would translate into benefits perceptible by patients or their loved ones.

As in other trials of antiamyloid antibodies, many of the people who received lecanemab in the phase 3 trial experienced amyloid-related imaging abnormalities (ARIA)—a term that describes brain swelling and bleeding. ARIA occurred in more than 21% of those who were on the drug; 17% experienced brain bleeds, but none of the ARIA cases was life-threatening, according to the Eisai and Biogen press release.

Still, one reason to think lecanemab contributed to the woman's death is that her autopsy revealed widespread cerebral amyloid angiopathy (CAA), a condition in which amyloid deposits gradually replace the smooth muscle of blood vessel walls. Castellani, Nicoll, and others who reviewed her case suspect CAA made her blood vessels vulnerable to weakening when lecanemab did what it is expected to do: strip amyloids from the brain. The tPA treatment then likely ruptured those weakened vessels, leading to serious ARIA—and apparently fatal brain bleeding, according to the Northwestern report authors and independent CAA or Alzheimer's experts.

Nearly half of Alzheimer's patients also have CAA—including, according to STAT, the man whose death was previously linked to combining lecanemab and blood thinners. Eisai screened potential trial participants with tests often used to detect moderate or serious CAA. For example, applicants had MRI brain scans and anyone whose scan showed more than four "microhemorrhages"—tiny bleeds—or other signs of possibly serious CAA were not allowed to enroll. But the condition can be hard to detect says Charidimou, who studies CAA. The two deaths show that even in the trial population, some patients with serious CAA slipped through.

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Many Alzheimer's patients with CAA also suffer from other ailments, such as atrial fibrillation, that are normally treated with blood thinners, says Matthew Schrag, a Vanderbilt University physician and neuroscientist who specializes in CAA and assessed the report on the woman's death for Science. That means both risk factors are likely to be present in a significant fraction of the patients who might be prescribed lecanemab if it is approved and marketed widely. Training physicians to interpret tests for CAA will be key to ensure that vulnerable Alzheimer's patients and their caregivers are properly informed and warned about the possible hazards of lecanemab, Charidimou says.

Assuming a close look at Clarity AD's data validates the companies' press release, lecanemab could still help early Alzheimer's patients who don't have moderate or severe CAA, says University of Kentucky neuroscientist Donna Wilcock, who also reviewed the report on the death. "Even if that [only] means 6 or 12 more months of knowing who their kids are … it's meaningful to dementia patients and their families."

But FDA should require meticulous screening for CAA and a warning against concurrent tPA use, Wilcock adds. "If lots of people [on lecanemab] who go into the hospital with garden-variety strokes end up dying, that sets the field back decades." FDA has promised to make a decision on whether to approve lecanemab, and impose any conditions on its use, by 6 January 2023.

Science, 27 November 2022

https://science.org

Major obesity advance takes out targeted fat depots anywhere in the body

2022-12-01

The fat cells of an elite athlete can appear quite different to those in an obese subject, and technologies that make one function more like the other could unlock powerful new therapies for the condition. Scientists are reporting an exciting advance in this field, demonstrating how positively-charged nanomaterials can be injected into unhealthy fat to return it to a healthy state, laying the foundation for treatments that selectively target fat depots anywhere in the body.

Led by scientists at Columbia University, the research was published across two papers and centers on the different functions fat cells can take on in the human body, and the difference between healthy fat metabolism and

Scientists have used positively charged nanomaterials to selectively target fat depots in the bodies of mice.

unhealthy fat formation. Fat cells store energy in the form of lipids, but when they're tasked with taking on too much, they start to grow large and undergo changes to specific genes, ultimately leading to obesity.

The research team set out to remodel these fat cells rather than simply destroy them, and have found success using a positively charged nanomaterial called PAMAM generation 3 (P-G3). The scientists were inspired to deploy P-G3 against fat cells after finding that some fat tissue contains a negatively charged extracellular matrix (ECM), the support structure for the cells. This raised the possibility that the ECM could act as a transport system for positively charged molecules.

So, the team injected P-G3 into obese mice and indeed found that it spread rapidly throughout the fat tissue. They were surprised to find, however, that the nanomaterial had the effect of shutting down the lipid storage function of the fat cells, effectively returning them to a younger, healthier state. The mice lost weight as a result.

"With P-G3, fat cells can still be fat cells, but they can't grow up," said study author Kam Leon. "Our studies highlight an unexpected strategy to treat visceral adiposity and suggest a new direction of exploring cationic nanomaterials for treating metabolic diseases."

While the nanomaterial had the effect of neutralizing the lipid storage of the fat cells, it still allowed them to carry out their other functions, and even promoted the formation of new fat cells. The effect was mice with smaller, younger and more metabolically healthy fat cells, like those seen in newborns and athletes. Promisingly, the scientists also demonstrated the technique on human fat biopsies, boding well for the path to clinical use.

What is unique about the technology is its potential to offer targeted treatment for obesity. Fat "depots," as they're called, tend to be spaced intermittently around the body rather than forming one continuous lump of flabby tissue, but treating them in a selective manner has proven challenging. The scientists imagine one day using their technique to tackle specific fat depots, such as a pot belly or double chin, in the same way Botox is used to target specific patches of skin.

"We're very excited to discover that cationic charge is the secret to targeting adipose tissue," said team leader Li Qiang. "Now we can shrink fat in a depot-specific manner – anywhere we want – and in a safe way without destroying fat cells. This is a major advance in treating obesity."

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Further, because obesity is a driver of so many adverse health effects, from diabetes, to cancer, to cardiovascular disease, the scientists believe the technology could become a powerful new platform to deliver drugs and gene therapy to select fat depots. This could see drugs previously proven unsafe when administered systemically repurposed for use in a targeted manner.

The research was published in the journals Nature Nanotechnology and Biomaterials.

New Atlas, 1 December 2022

https://newatlas.com

Mother loses peripheral vision from apparent exposure to mercury in beauty creams. Toxic levels in her home put family at risk, say experts

2022-11-29

A woman in Minnesota lost part of her vision and inadvertently put her entire household at risk of mercury poisoning, most likely from using beauty creams containing high levels of the toxic chemical, according to a case report shared exclusively with CNN.

The report, shared by Dr. Erin Batdorff with the Minnesota Poison Control System, details the extensive symptoms experienced by the woman, also a mother, and how home visits conducted by the Minnesota Pollution Control Agency (MPCA) found high levels of mercury in her children's bedrooms, bedding, household towels and laundry area.

"People have no idea," Batdorff, a fellow in medical toxicology who examined the woman in her home, told CNN. "No one intentionally wants to hurt themselves or their family members. But it's out there and you can't see it, you can't smell it. There's no way [for consumers] to know whether [mercury] is in the creams or not because it's not on the labels."

The woman, whose name has been concealed in the report to protect her identity, was referred to Batdorff's team after she reported an array of symptoms to multiple doctors, ranging from insomnia and leg pain to muscle weakness, fatigue and, eventually, the loss of her peripheral vision. Clinical tests revealed elevated levels of mercury in her blood and urine.

Batdorff explained that the most common symptoms she sees from potential mercury poisoning is tingling or numbness in a patient's hands

"Anyone using a skin lightening product that contains mercury, unfortunately, is going to put the whole household at risk."

or feet. She described the woman's loss of vision as "a more extreme and permanent symptom."

"She will not recover her vision," Batdorff told CNN. "So being a young woman that now has vision loss is really frightening and pretty concerning."

The toxicologist added that there are likely to be many more people out there who are being exposed to toxic levels of mercury and are not showing symptoms, or at least not yet.

Following the referral, Batdorff and the MPCA visited the woman's house twice, about a year apart.

On the first visit she showed the team skin whitening beauty creams from abroad but said she was no longer using them. The agency found the amount of mercury in two of those products to be several thousand times higher than the permitted levels of 1 part per million (ppm) in cosmetics and urine tests revealed high levels of mercury in her body (23mcg/liter) -- but mercury was not noted as an ingredient on the products, according to the team.

At that time, the agency did not consider the levels of mercury in her home to be a concern, but over the course of a year, the mother had increasingly elevated levels of mercury in her body, the case report states.

A second home visit in 2022 found that two new beauty products the woman had bought at a local market, one of which was not labelled as skin whitening but is known to be used for this, also contained high levels of mercury. The products found in her home were empty from use, but the MPCA team tested new unopened versions of the same product, finding extremely high levels of mercury of 11,000 and 18,000ppm.

"There are limited outlets for availability, and we have no reason or evidence to believe there would be any difference in the products," said John Gilkeson, Toxics Reduction Specialist at the MPCA, who tested the woman's home and has conducted three visits to the homes of people using skin whitening creams in recent years.

New urine tests confirmed that the mercury level in her body had risen to 46.6 micrograms/liter -- more than nine times the level considered normal (5 micrograms/liter)| -- and certain areas in her home now also contained elevated levels of mercury, putting her family at risk.

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Background mercury levels below 200 nanograms per cubic meter (ng/m3) are not considered a concern, Gilkeson explained. But the children's bedrooms recorded levels of up to 400 ng/m3 and their towels read up to 600 mg/m3, according to the case report.

Levels of up to 300 mg/m3 were found in the washing machine, where mercury likely accumulated as clothes worn by the mother were laundered, in turn contaminating other clothing and materials that go into the machine

Urine tests on one of her children found that they now had elevated levels of mercury in their body, albeit much lower than their mother at 6.88 micrograms/liter.

One of many families at risk

The woman's story is one of many in the state of Minnesota and other parts of the US in recent years where women and entire households are believed to have been exposed to inorganic mercury from the prolonged use of skin whitening products that fail to disclose they contain harmful levels of the toxic chemical.

The woman was "incredibly frustrated," said Batdorff. "She had bought things that didn't say lightening, thinking that they would be safe," said Batdorff.

Beauty products containing mercury remain easily accessible in local malls and markets throughout the US and through online retailers, say experts, helped by the fact they fail to list mercury as an ingredient. Batdorff and other experts are calling for greater awareness, regular testing of products and stricter enforcement of regulations to help combat the problem.

In 2020, a health advisory was issued in Minnesota after a woman developed kidney damage, a rash and other symptoms including insomnia and depression following the use of skin whitening creams that again failed to disclose they contained mercury.

A widespread issue

Screening studies by the biomonitoring team within the Minnesota Department of Health (MDH) in 2015 and 2019 also found elevated levels of mercury in the urine of multiple people who used skin whitening products, including pregnant women. Previously unpublished results from these studies shared exclusively with CNN show that follow-up home visits for some of these women revealed high levels of mercury vapor in the air

-- particularly in their washing machines -- with readings as high as 1,800 and 2,000 ng/m3.

Lori Copan, Chief of the Exposure Prevention and Education Section at the California Department of Health reviewed the findings for the Minnesota mother and told CNN: "[The case of this woman] unfortunately is similar to others we have seen in California, with a person experiencing symptoms for years without adequate recognition of potential mercury toxicity from a skin lightening product by health-care providers." She added that her team has seen around one hundred cases of toxicity from people using these creams, or their family members.

"Anyone using a skin lightening product that contains mercury, unfortunately, is going to put the whole household at risk," said Batdorff. "There's no way to make sure that no contamination of the mercury will go to other household members. That's just not how mercury works."

'The number one possible source of mercury exposure'

Mercury has long been used in skin whitening products due to its ability to block the production of melanin, the pigment that gives color to skin. US Federal Drug Agency regulations and the Minamata Convention on Mercury -- an international treaty to protect human health and the environment from mercury -- limit the use of mercury in cosmetics, excluding those used around the eye area, to 1mg/kg of mercury, also known as 1 part per million (ppm).

The products found in the woman's home ranged from 4590ppm to 18,000ppm.

At high levels, the inorganic mercury typically found in these products is extremely toxic. Chronic exposure can lead to kidney and liver damage, as well as neurological damage including personality changes, anxiety, depression, early childhood development issues and, as seemingly shown in this case, vision loss.

"With inorganic mercury it's that chronic long-term exposure that concerns me the most," said Batdorff. "It's more subtle but ends up building up in our system and is hard to eliminate, especially when it gets into the brain ... and once mercury has crossed over into the brain and our nervous system, it can cause a lot of different side effects."

For Batdorff and other experts, finding people early and removing the sources of mercury before they cause permanent damage is crucial.

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"When we're thinking about exposures in pregnant women, women of childbearing age and babies and children, you know, we don't want people in those groups to be having higher mercury exposure," said Jessica Nelson, Program Director for the Minnesota Biomonitoring program within MDH, who led the 2015 and 2019 studies.

"We need to be sure women know that products can have mercury in them. And we need to focus on women who speak languages other than English and different ways of sharing the information, ideally through community partners."

Previous data from the MDH has found Somali, Latina and Hmong populations in Minnesota -- who are among the largest cultural communities in the state -- to be at particular risk from mercury exposure in beauty products.

The mother in the case report was originally from Somalia.

"The use of skin-lightening is a now a public health crisis in the Somali community and other communities of color," said Amira Adawe, Founder and Executive Director of the Beautywell Project, which works to address colorism and the harms of skin whitening in communities in Minnesota, nationwide and more globally. "I have met some women that have been using these products 10 to 15 years ...[and] I always get phone calls from individuals who are dealing with the side effects of mercury."

Adawe added that many doctors miss the need to screen these women for mercury exposure unless they are familiar with the issue of skin-lightening practices in the Somali and other communities.

"I would say this is the number one possible source of mercury exposure for people in Minnesota," agreed Gilkeson at the MPCA. "It affects the individual who's using the product and affects their family or children and their community."

The state's department of health told CNN it hopes to work with additional clinics and health care providers to offer urine mercury screening as well as educate both health providers and the public -- particularly focusing on clinics who serve women who may be most at risk of exposure.

Many shop owners also unaware

Earlier this year, the city of Minneapolis ran a skin lightening education program working with East African communities at a popular community hub in the city of Minneapolis, the Karmel Mall as well as other malls in the

area. The aim was to inform people, including shop owners and customers, about the risks of mercury found in many skin whitening and other beauty products as well as to test the wide range of items sold across the malls to help identify the products posing the most risk, and their countries of origin.

The team spoke with more than 200 vendors and customers and disposed of around 900 products containing high levels of mercury -- many of which were manufactured in Pakistan -- over the three months that the program ran, said Fatou Barry, program assistant on the project, who visited the mall almost daily during this time.

Barry said most vendors had no awareness of the products containing harmful ingredients like mercury and were "shocked" when they realized the risk to their community. Many others, however, closed their stores when they learned city officials were visiting, Barry said.

In a reflection paper describing the strategy and impact of her team's efforts, Barry wrote that the biggest taken away from the whole experience was how important it was to keep showing up and engaging with the community. "Passively sending or posting flyers wasn't nearly as effective as coming in and going [from] vendor to vendor," she wrote.

A need for better enforcement

To tackle the issue across affected communities, Nelson from the biomonitoring team believes a multi-pronged approach is essential. "The urine testing, the product testing and getting products off shelves. The community outreach and engagement," she outlined. "They all need different voices at the table about how to do that best and most effectively."

In addition to these approaches, Adawe stressed the need for better enforcement of regulations. "The products are widely available in ethnic malls like Karmel and the state has not actively regulated these products," she said. "I visited [a few months ago] to check if the products we tested that contained mercury are still available...and saw all the mercury containing skin-lightening products displayed on the shelves."

The MPCA is responsible for enforcing regulations on these products in the state, and issuing penalties. In response to Adawe's concerns, a spokesperson for the agency told CNN that the MPCA "prioritizes education and outreach efforts to help vendors identify and remove

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products from shelves and will take enforcement actions when appropriate."

They added that "skin-lightening creams present a unique challenge because their labeling doesn't often list mercury as an ingredient and each product must be tested to determine if mercury is present above the regulatory limit."

To further increase knowledge among affected communities, MDH has an awareness and education grant of up to $200,000 to fund various community organizations, NGOs and city health departments working in this space, including Adawe's.

"Through Beautywell we do training for health care providers and public health workers to understand about colorism, skin-lightening practice and ways they can identify the health impact of this practice," explained Adawe. "The use of skin-lightening products in the Somali community is high and so we need to continue do health education in this community and teach women to embrace their skin color."

CNN, 29 November 2022

https://edition.cnn.com

"Nanopillared" material removes microplastics from water via magnetism

2022-11-29

While the purification of wastewater once just involved the removal of traditional pollutants, it now also entails the removal of microplastic particles. A new powder reportedly does the job much quicker and more thoroughly than has previously been possible.

Developed by a team of scientists at Australia's RMIT University, the powder would ideally get mixed into untreated wastewater at existing treatment plants. And while it just looks like a plain white powder to the naked eye, it's actually made up of microscopic, ferromagnetic "nanopillared structures."

Each one of those structures in turn consists of two sheets of metal organic framework (MOF) material, with an array of carbon-encapsulated iron oxide nanopillars sandwiched in a gap between them. This arrangement results in a large amount of surface area, to which even the smallest of passing microplastic particles cling.

The powder would ideally get mixed into untreated wastewater at existing treatment plants.

Once the powder has been swirled around in the wastewater for a short time, a magnet is used to remove all the nanopillared structures, along with the microplastic particles they have adsorbed.

In lab tests, doing so successfully removed all of the particles from tainted water samples in just one hour – what's more, the structures could be reused up to six times. And as an added benefit, the structures also adsorbed methylene blue, which had been added to the water to represent more traditional dissolved pollutants.

By contrast, conventional purification techniques take days to complete, and even then aren't as thorough.

"Our powder additive can remove microplastics that are 1,000 times smaller than those that are currently detectable by existing wastewater treatment plants," said the lead scientist, Prof. Nicky Eshtiaghi. "We are looking for industrial collaborators to take our invention to the next steps, where we will be looking at its application in wastewater treatment plants."

The research is described in a paper that was recently published in the Chemical Engineering Journal.

New Atlas, 29 November 2022

https://newatlas.com

Researchers discover new form of antimicrobial resistance

2022-11-30

Australian researchers have uncovered a new form of antimicrobial resistance (AMR), undetectable using traditional laboratory testing methods, in a discovery set to challenge existing efforts to monitor and tackle one of the world's greatest health threats.

AMR is expected to claim 10 million lives a year by 2050, with scientists racing to understand and get ahead of the diminishing benefits of antibiotics.

Now, a team led by Dr. Timothy Barnett, Head of the Strep A Pathogenesis and Diagnostics team at the Wesfarmers Centre of Vaccines and Infectious Diseases, based at Telethon Kids Institute in Perth, Western Australia, has unearthed a critical clue to the way some bacteria are managing to dodge antibiotics—a finding expected to be the tip of the iceberg.

Antimicrobial resistance is expected to claim 10 million lives a year by 2050, with scientists racing to understand and get ahead of the diminishing benefits of antibiotics.

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In research published today in Nature Communications, the team revealed a new mechanism that enables bacteria to take up nutrients from their human host and bypass antibiotic treatment. The researchers made the discovery while investigating antibiotic susceptibility of group A streptococcus—a potentially deadly bacteria often found in the throat and on the skin.

"Bacteria need to make their own folates to grow, and in turn, cause disease. Some antibiotics work by blocking this folate production to stop bacteria growing and treat the infection," Dr. Barnett explained.

"When looking at an antibiotic commonly prescribed to treat group A strep skin infections, we found a mechanism of resistance, where for the first time ever, the bacteria demonstrated the ability to take folates directly from its human host when blocked from producing their own. This makes the antibiotic ineffective and the infection would likely worsen when the patient should be getting better."

"This new form of resistance is undetectable under conditions routinely used in pathology laboratories, making it very hard for clinicians to prescribe antibiotics that will effectively treat the infection, potentially leading to very poor outcomes and even premature death.

"Unfortunately, we suspect this is just the tip of the iceberg—we have identified this mechanism in group A strep but it's likely it will be a broader issue across other bacterial pathogens," Dr. Barnett said. The team's research highlighted that understanding AMR is far more complex than first thought.

"AMR is a silent pandemic of much greater risk to society than COVID-19—in addition to 10 million deaths per year by 2050, the World Health Organization estimates AMR will cost the global economy $100 trillion if we can't find a way to combat antibiotic failure," he added. "Without antibiotics, we face a world where there will be no way to stop deadly infections, cancer patients won't be able to have chemotherapy and people won't have access to have life-saving surgeries.

"In order to preserve the long-term efficacy of antibiotics, we need to further identify and understand new mechanisms of antibiotic resistance, which will aid in the discovery of new antibiotics and allow us to monitor AMR as it arises."

First author Kalindu Rodrigo will now focus on developing testing methods to detect this antibiotic resistance mechanism to enable effective treatment.

"In the context of increasing AMR, it is important to have new diagnostic tools that can rapidly detect antibiotic resistance, including host-dependent resistance. Therefore, we hope to develop rapid point-of-care tests that can be used in remote settings where group A strep infections are endemic," Rodrigo said.

"It is vital we stay one step ahead of the challenges of AMR, and as researchers, we should continue to explore how resistance develops in pathogens and design rapid accurate diagnostic methods and therapeutics. On the other hand, equal efforts should be taken at all levels of the society including patients, health professionals and policy makers to help reduce the impacts of AMR," Rodrigo concluded.

Phys Org, 30 November 2022

https://phys.org

Fossil overturns more than a century of knowledge about the origin of modern birds

2022-11-30

Fossilized fragments of a skeleton, hidden within a rock the size of a grapefruit, have helped upend one of the longest-standing assumptions about the origins of modern birds.

Researchers from the University of Cambridge and the Natuurhistorisch Museum Maastricht found that one of the key skull features that characterizes 99% of modern birds—a mobile beak—evolved before the mass extinction event that killed all large dinosaurs, 66 million years ago.

This finding also suggests that the skulls of ostriches, emus and their relatives evolved "backwards," reverting to a more primitive condition after modern birds arose.

Using CT scanning techniques, the Cambridge team identified bones from the palate, or the roof of the mouth, of a new species of large ancient bird, which they named Janavis finalidens. It lived at the very end of the Age of Dinosaurs and was one of the last toothed birds to ever live. The arrangement of its palate bones shows that this "dino-bird" had a mobile, dexterous beak, almost indistinguishable from that of most modern birds.

While this discovery does not mean that the entire bird family tree needs to be redrawn, it does rewrite our under-standing of a key evolutionary feature of modern birds.

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For more than a century, it had been assumed that the mechanism enabling a mobile beak evolved after the extinction of the dinosaurs. However, the new discovery, reported in the journal Nature, suggests that our understanding of how the modern bird skull came to be needs to be re-evaluated.

Each of the roughly 11,000 species of birds on Earth today is classified into one of two over-arching groups, based on the arrangement of their palate bones. Ostriches, emus and their relatives are classified into the palaeognath, or "ancient jaw" group, meaning that, like humans, their palate bones are fused together into a solid mass.

All other groups of birds are classified into the neognath, or "modern jaw" group, meaning that their palate bones are connected by a mobile joint. This makes their beaks much more dexterous, helpful for nest-building, grooming, food-gathering, and defense.

The two groups were originally classified by Thomas Huxley, the British biologist known as "Darwin's Bulldog" for his vocal support of Charles Darwin's theory of evolution. In 1867, he divided all living birds into either the "ancient" or "modern" jaw groups. Huxley's assumption was that the "ancient" jaw configuration was the original condition for modern birds, with the "modern" jaw arising later.

"This assumption has been taken as a given ever since," said Dr. Daniel Field from Cambridge's Department of Earth Sciences, the paper's senior author. "The main reason this assumption has lasted is that we haven't had any well-preserved fossil bird palates from the period when modern birds originated."

The fossil, Janavis, was found in a limestone quarry near the Belgian-Dutch border in the 1990s and was first studied in 2002. It dates from 66.7 million years ago, during the last days of the dinosaurs. Since the fossil is encased in rock, scientists at the time could only base their descriptions on what they could see from the outside. They described the bits of bone sticking out from the rock as fragments of skull and shoulder bones, and put the unremarkable-looking fossil back in storage.

Nearly 20 years later, the fossil was loaned to Field's group in Cambridge, and Dr. Juan Benito, then a Ph.D. student, started giving it another look.

"Since this fossil was first described, we've started using CT scanning on fossils, which enables us to see through the rock and view the entire fossil," said Benito, now a postdoctoral researcher at Cambridge, and the

paper's lead author. "We had high hopes for this fossil—it was originally said to have skull material, which isn't often preserved, but we couldn't see anything that looked like it came from a skull in our CT scans, so we gave up and put the fossil aside."

During the early days of COVID-19 lockdown, Benito took the fossil out again. "The earlier descriptions of the fossil just didn't make sense—there was a bone I was really puzzled by. I couldn't see how what was first described as a shoulder bone could actually be a shoulder bone," he said.

"It was my first in-person interaction in months: Juan and I had a socially distanced outdoor meeting, and he passed the mystery fossil bone to me," said Field, who is also the Curator of Ornithology at Cambridge's Museum of Zoology. "I could see it wasn't a shoulder bone, but there was something familiar about it."

"Then we realized we'd seen a similar bone before, in a turkey skull," said Benito. "And because of the research we do at Cambridge, we happen to have things like turkey skulls in our lab, so we brought one out and the two bones were almost identical."

The realization that the bone was a skull bone, and not a shoulder bone, led the researchers to conclude that the unfused "modern jaw" condition, which turkeys share, evolved before the "ancient jaw" condition of ostriches and their relatives. For an unknown reason, the fused palates of ostriches and kin must have evolved at some point after modern birds were already established.

Two of the key characteristics we use to differentiate modern birds from their dinosaur ancestors are a toothless beak and a mobile upper jaw. While Janavis finalidens still had teeth, making it a pre-modern bird, its jaw structure is that of the modern, mobile kind.

"Using geometric analyses, we were able to show that the shape of the fossil palate bone was extremely similar to those of living chickens and ducks," said Pei-Chen Kuo, a co-author of the study. Added co-author Klara Widrig: "Surprisingly, the bird palate bones that are the least similar to that of Janavis are from ostriches and their kin." Both Kuo and Widrig are Ph.D. students in Field's lab at Cambridge.

"Evolution doesn't happen in a straight line," said Field. "This fossil shows that the mobile beak—a condition we had always thought post-dated the origin of modern birds, actually evolved before modern birds existed.

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We've been completely backwards in our assumptions of how the modern bird skull evolved for well over a century."

The researchers say that while this discovery does not mean that the entire bird family tree needs to be redrawn, it does rewrite our understanding of a key evolutionary feature of modern birds.

And what happened to Janavis? It, like the large dinosaurs and other toothed birds, did not survive the mass extinction event at the end of the Cretaceous period. The researchers say that this may be because of its large size: Janavis weighed around 1.5 kilograms and was the size of a modern vulture.

It's likely that smaller animals—like the "wonderchicken," identified by Field, Benito, and colleagues in 2020, which comes from the same area and lived alongside Janavis—had an advantage at this point in Earth's history since they had to eat less to survive. This would have been beneficial after the asteroid struck the Earth and disrupted global food chains.

Phys Org, 30 November 2022

https://phys.org

Experimental "smart" bandage speeds healing by zapping chronic wounds

2022-11-25

Chronic wounds such as diabetic skin ulcers can be very slow to heal, potentially leading to amputations or sometimes even death. A new bandage could speed their healing by delivering electrical stimulation, but only as needed.

Created by scientists at Stanford University, the prototype device is made up of two layers. On top is a polymer film just 100 microns thick, upon which the electronic components are mounted. On the underside of that film is the other layer, a "rubbery, skin-like" hydrogel which lies in contact with the wound.

Biosensors in the bandage continuously monitor the wound's electrical impedance and temperature. Past research has shown that impedance increases as wounds heal, whereas the temperature drops as inflammation subsides.

If those metrics indicate that the wound is having difficulty healing, an electrical stimulator in the bandage is triggered to deliver a small electrical current into the underlying tissue. As is the case with other wound-zapping dressings, doing so is claimed to accelerate tissue closure and reduce infection, by speeding the rate at which keratinocytes (skin cells) migrate into the wound site, and by killing bacteria.

As the bandage goes about its business, it uses an onboard radio antenna to wirelessly communicate with a paired smartphone. A caregiver utilizing that phone can thereby check on the state of the wound, without having to repeatedly disturb it by removing the bandage. That said, when it is time to take the bandage off, warming it to 40º C (104º F) causes the hydrogel to harmlessly detach from the wound surface.

In tests performed on mice, use of the device was found to speed healing times by about 25%, and to boost skin regrowth by around 50%. The scientists stress that it may be some time before the bandage can be utilized on people, as it still needs to be scaled up to human-use size, and the production costs have to be reduced.

It may also ultimately incorporate more sensors, to measure pH, metabolites and biomarkers. The researchers believe that it should then both help chronic wounds to heal faster and boost our understanding of how such wounds heal.

The flexible device combines a layer of electronics with a layer of hydrogel.

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"With stimulation and sensing in one device, the smart bandage speeds healing, but it also keeps track as the wound is improving," said Dr. Artem Trotsyuk, co-first author of a paper on the study. "We think it represents a new modality that will enable new biological discovery and the exploration of previously difficult-to-test hypotheses on the human healing process."

The paper was recently published in the journal Nature Biotechnology.

New Atlas, 25 November 2022

https://newatlas.com

What octopus and human brains have in common

2022-11-25

Cephalopods like octopuses, squids and cuttlefish are highly intelligent animals with complex nervous systems. In Science Advances, a team led by Nikolaus Rajewsky of the Max Delbrück Center has now shown that their evolution is linked to a dramatic expansion of their microRNA repertoire.

If we go far enough back in evolutionary history, we encounter the last known common ancestor of humans and cephalopods: a primitive wormlike animal with minimal intelligence and simple eyespots. Later, the animal kingdom can be divided into two groups of organisms—those with backbones and those without. While vertebrates, particularly primates and other mammals, went on to develop large and complex brains with diverse cognitive abilities, invertebrates did not. With one exception: the cephalopods.

Scientists have long wondered why such a complex nervous system was only able to develop in these mollusks. Now, an international team led by researchers from the Max Delbrück Center and Dartmouth College in the United States has put forth a possible reason. In a paper published in Science Advances, they explain that octopuses possess a massively expanded repertoire of microRNAs (miRNAs) in their neural tissue—reflecting similar developments that occurred in vertebrates.

"So this is what connects us to the octopus," says Professor Nikolaus Rajewsky, scientific director of the Berlin Institute for Medical Systems Biology of the Max Delbrück Center (MDC-BIMSB), head of the Systems Biology of Gene Regulatory Elements Lab, and the paper's last author. He explains that this finding probably means miRNAs play a fundamental role in the development of complex brains.

Octopuses are very curious and can remember things. They can also recognize people and actually like some more than others.

In 2019, Rajewsky read a publication about genetic analyses conducted on octopuses. Scientists had discovered that a lot of RNA editing occurs in these cephalopods—meaning they make extensive use of certain enzymes that can recode their RNA.

"This got me thinking that octopuses may not only be good at editing, but could have other RNA tricks up their sleeve too," says Rajewsky. And so he began a collaboration with the Stazione Zoologica Anton Dohrn marine research station in Naples, which sent him samples of 18 different tissue types from dead octopuses.

The results of the analyses were surprising: "There was indeed a lot of RNA editing going on, but not in areas that we believe to be of interest," says Rajewsky. The most interesting discovery was in fact the dramatic expansion of a well-known group of RNA genes, microRNAs.

A total of 42 novel miRNA families were found—specifically in neural tissue and mostly in the brain. Given that these genes were conserved during cephalopod evolution, the team concludes they were clearly beneficial to the animals and are therefore functionally important.

Rajewsky has been researching miRNAs for more than 20 years. Instead of being translated into messenger RNAs, which deliver the instructions for protein production in the cell, these genes encode small pieces of RNA that bind to messenger RNA and thus influence protein production. These binding sites were also conserved throughout cephalopod evolution—another indication that these novel miRNAs are of functional importance.

New microRNA families

"This is the third-largest expansion of microRNA families in the animal world, and the largest outside of vertebrates," says lead author Grygoriy Zolotarov, MD, a Ukrainian scientist who interned in Rajewsky's lab at MDC-BIMSB while finishing medical school in Prague, and later. "To give you an idea of the scale, oysters, which are also mollusks, have acquired just five new microRNA families since the last ancestors they shared with octopuses—while the octopuses have acquired 90."

Oysters, adds Zolotarov, aren't exactly known for their intelligence.

Rajewsky's fascination with octopuses began years ago, during an evening visit to the Monterey Bay Aquarium in California. "I saw this creature sitting on the bottom of the tank and we spent several minutes—so I thought—looking at each other." He says that looking at an octopus is very different to looking at a fish: "It's not very scientific, but their eyes do exude a

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sense of intelligence." Octopuses have similarly complex "camera" eyes to humans.

From an evolutionary perspective, octopuses are unique among invertebrates. They have both a central brain and a peripheral nervous system—one that is capable of acting independently. If an octopus loses a tentacle, the tentacle remains sensitive to touch and can still move. The reason why octopuses are alone in having developed such complex brain functions could lie in the fact that they use their arms very purposefully—as tools to open shells, for instance.

Octopuses also show other signs of intelligence: They are very curious and can remember things. They can also recognize people and actually like some more than others. Researchers now believe that they even dream, since they change their color and skin structures while sleeping.

Alien-like creatures

"They say if you want to meet an alien, go diving and make friends with an octopus," says Rajewsky. He's now planning to join forces with other octopus researchers to form a European network that will allow greater exchange between the scientists. Although the community is currently small, Rajewsky says that interest in octopuses is growing worldwide, including among behavioral researchers.

He says it's fascinating to analyze a form of intelligence that developed entirely independently of our own. But it's not easy: "If you do tests with them using small snacks as rewards, they soon lose interest. At least, that's what my colleagues tell me," says Rajewsky.

"Since octopuses aren't typical model organisms, our molecular-biological tools were very limited," says Zolotarov. "So we don't yet know exactly which types of cell express the new microRNAs." Rajewsky's team are now planning to apply a technique, developed in Rajewsky's lab, which will make the cells in octopus tissue visible at a molecular level.

Phys Org, 25 November 2022

https://phys.org

Floodwaters essential for ecosystem rejuvenation say experts

2022-11-27

Along with the human, infrastructure and economic devastation wrought by recent floods, come environmental costs and even benefits.

In the past two years, most Australian states have been affected by severe rainfall and inundation. Some places have been hit with repeatedly.

From an environmental perspective, floods can trigger landslides and erosion, pollute waterways, and drown or displace wildlife.

On the positive side, rainfall and flooding is essential to river and floodplain ecosystems, often triggering a boom in plant, insect and animal growth.

What's in the water?

Flood waters can carry contaminants and pollution from various sources – sewage, petrol stations, industrial and agricultural sites.

In an Australian first, Victoria's Environmental Protection Authority is partnering with the State Emergency Service and Natural Hazards Research Australia to undertake comprehensive sampling and analysis of bacteria and contaminants in floodwaters and sediments. The long list includes E.coli, trace elements, environmental DNA, hydrocarbons, phthalates, pesticides, pharmaceuticals and more.

Victoria's chief environmental scientist, Professor Mark Taylor tells Cosmos, "the upshot is, we're taking this opportunity not only to provide some insight about what's in this water, and why or why not it may pose a risks to the residents, but also for us to characterize unusual, large flood events."

"We're going to collect a really special and really unique data set. And to the best of our knowledge, no one has ever done this in Australia before."

Taylor expects the final results will be published mid 2023. Although, initial results have allayed some fears.

He hopes the work will help authorities and the public understand, "what's in the water? Are there any greater risks being dispersed in that water? And what are the sources of those contaminants? And that will help us understand what risks they may pose, both to the natural and human environment."

What are the environmental impacts of flooding?

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Polluted water isn't just a risk to people. Some ecologists fear parasites and pathogens might cause wildlife deaths when animals drink the water, according to reporting in The Guardian.

Floods can cause other contaminants and harmful materials like heavy metals, asbestos and PFAS to shift or be exposed.

There's also the movement of sediments. Queensland flooding washed some 50 million tonnes of sediment into waterways, including up to 5 tonnes affecting Moreton Bay according to an independent report by consultant Deloitte.

Rivers and floodplain ecosystems revel in the rain

Associate professor Paul Humphries, an ecologist with Charles Sturt University, says for river and floodplain ecosystems, flooding is a natural and essential process.

"There's a whole lot of animals out there – plants and fungi and bacteria – which specialise on those areas which are periodically flooded and periodically dry," he tells Cosmos.

"There'll be a burst of life of all those types of animals and plants when that water comes along. So really maintaining the biodiversity and the integrity and health of a river system, floods are required."

Humphries says the way humans seek to manage rivers, with dams for instance, reduces the frequency of small to medium floods. This can lead to a build-up of organic material on the floodplain, which when washed into the water can cause low oxygen, blackwater events and fish kills in the short term.

"But in the medium to long term, these floods are absolutely essential. The health of rivers would be majorly compromised if we didn't have them. So, I expect to see with these big floods, a boom in productivity on the floodplain and in the river itself. We're going to get a lot of animals and plants."

Trees can be both victims and beneficiaries of flooding, writes University of Melbourne botanist Dr Gregory Moore.

Some species like River Red Gums have evolved to depend on cycles of dry and wet periods. Whereas for others, the force of floodwaters and debris, or the water-logged soils can undermine the root systems of some trees, according to Moore.

Dead in the water

Many farm and native animals can't escape the floods. James Cook University ecologists estimate around 600,000 cows were killed – by drowning, or stranding – in 2019 Queensland floods. Floodwaters can also inundate habitats and trap, displace or drown wildlife, write Deakin University's Professor Euan Ritchie and Macquarie University's Chris Jolly.

Waterlogged waste streams

Like the Lismore Library which had to throw out almost 30,000 books, cleaning up after floods generates huge volumes of new landfill waste. Deloitte says a year's worth of landfill was swept into Queensland waterways, while some 30,000 m3 of extra waste was sent to council tips and recycling centres.

In Queensland, environmental the clean-up such as removing debris is estimated to have cost $42 million according to Deloitte.

Rivers of life

As the massive floodwaters move down the Murray River, towns are desperately sandbagging and building levees to keep the water out, but at the same time are concerned that irrigation pumps will be flooded and switched off.

This "boom-and bust" cycle will occur all along the river. The Coorong wetlands are looking forward to a long drink.

Humphries says, "the reason why humans, have settled around rivers is the same reason why animals and plants do so well. It's because rivers provide the energy, the productivity, and the biodiversity that we've taken advantage of."

"Floods are required. If they don't occur, then you you're basically losing a lot of that the biodiversity of other that makes up a river and its floodplain."

Cosmos, 27 November 2022

https://cosmosmagazine.com

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Groundbreaking New Technology Allows People To Listen to Music Through Touch

2022-11-26

A ground-breaking prototype developed by experts from the Department of Electronics at the University of Malaga and members of the R&D group "Electronics for Instrumentation and Systems," will allow those with hearing loss to listen to music through the sense of touch.

It consists of an audio-tactile algorithm that transforms monophonic music into tangible stimuli based on vibration utilizing "tactile illusions." According to the researchers, "It's like 'hacking' the nervous system to receive a different response to the real stimulus sent."

"What we want to achieve in the long term is for people who do not hear to be able to 'listen' to music", assures researcher Paul Remache, the main author of this paper, who insists on the power of music to influence mood, as well as its possibilities as a therapy for mental disorders and treatment of pain.

The researchers predict that this will lead to a portable terminal that may be brought to a concert since this prototype will be easily transferable to technological devices like smartphones.

Mapping music

This young researcher, working with professors Andrés Trujillo and Fernando Vidal from the UMA, developed an algorithm that can transform musical features and structures taken from MIDI files—Musical Instrument Digital Interface—into "vibrotactile stimuli."

"It's something similar to mapping music", explains Remache, who adds that this is possible because this type of file not only can be played and generate sound, but also provide "symbolic representations".

Controlling vibrations

Current models do not warrant the correspondence between the emotional response to music and the vibrotactile version of it. In view of this, these engineers of the UMA propose an arrangement of the "tactile illusions" in order to improve and extend the spectrum of musical features, adding dynamics to the vibration in the form of movement, changes of direction, and location.

The prototype consists of an audio-tactile algorithm that converts monophonic music into tangible stimuli based on vibration utilizing "tactile illusions."

"It is a challenging process since the perceptible frequency range of the skin is lower than that of the auditory system, which may cause the loss of some musical features", they explain.

Different emotional response

The results of the first experiments, in which more than fifty volunteers participated, indicate that the arrangement of "tactile illusions" elicits more positive than negative emotions. They are also perceived as more agreeable and stimulating than the audio, provoking a different emotional response from that of the original music.

Smart instrumentation and application in healthcare

This first prototype was presented in the 11th International Workshop on Haptic & Audio Interaction Design (United Kingdom) –the biggest international event specialized in these areas of study– after being published in the scientific journal LNCS. At present, the researchers of the UMA are working on a second model and continuing with the experiments.

The research is the product of Paul Remache's doctoral thesis and is part of the National Plan project "Smart instrumentations and application in healthcare."

SciTechDaily, 26 November 2022

https://scitechdaily.com

Where did the PFAS in your blood come from? These computer models offer clues

2022-11-28

Downstream of a Chemours fluorochemical manufacturing plant on the Cape Fear River in North Carolina, people living in Brunswick and New Hanover counties suffer from higher-than-normal rates of brain tumors, breast cancers and other forms of rare — and accelerated — diseases.

Residents now know this isn't a coincidence. It's from years of PFAS contamination from Chemours.

It wasn't easy to make the connection. More than a decade of water testing and lawsuits identified the link between aggressive cancers and per-and polyfluoroalkyl substances, or PFAS – a class of more than 9,000 toxic and persistent man-made compounds known informally as "forever chemicals." They're commonly found in nonstick cookware, water-resistant clothing, firefighting foam, cosmetics, food packaging and recently in school uniforms and insecticides.

New research could help pinpoint "forever chemicals" exposure — giving communities a roadmap for cleanup and individuals direction on what to avoid.

The difficulty of tracing these chemicals to a specific source is that Americans — 97% of us, by one estimate — are exposed to potentially thousands of PFAS.

New research published in Science of the Total Environment now finds that tracing models can identify sources of PFAS contamination from people's blood samples. Instead of using environmental measures of PFAS as a proxy for how people are exposed, the methods use blood samples as a more direct way to map people's exposure.

"If this works, it would allow us to identify, without any prior knowledge, what people are being exposed to and how they're being exposed to it," Dylan Wallis, a lead author of the paper and toxicologist formerly at North Carolina State University, told EHN.

The research, while not yet perfect, marks the beginning of what could become a wide-scale method of determining where the PFAS in our blood came from—such as our food, drinking water or use of nonstick cookware—and how much of it came from each source. But its effectiveness hinges on the need to collect more comprehensive data on where PFAS occurs in people's bodies, the environment and sources. If scientists can collect this data, then these methods would be able to draw a roadmap for people's exposure, allowing us to pinpoint problem areas, avoid contamination and implement regulatory changes.

PFAS in blood samples

For this tracing method to work, scientists need an idea of which compounds exist in air, water, food and everyday products in a determined community. First, they have to know where to look for PFAS. This study used data from previous research to identify the types of PFAS in drinking water. Then, they test blood samples for which PFAS are in people's bodies—although using blood alone gives us only part of the contamination picture, Carla Ng, a chemical and biological engineer at University of Pittsburgh, told EHN. Once they match PFAS proportions in blood to what's in their drinking water, as in this study, they can gain clues to which sources contributed the chemicals showing up in people's blood.

"You start to build this picture of what are the inputs, what's the material they're getting their exposure from, and then what's in their blood," Ng, who was not involved in the study, explained.

The new study analyzed blood samples taken in 2018 and 2020 from residents in Wilmington, North Carolina, and three towns in El Paso County, Colorado. Both communities are near well-known PFAS polluters: the Chemours facility in North Carolina, which manufactures fluoropolymers for nonstick and waterproof products, and the Peterson Space Force Base in Colorado, which uses PFAS-containing firefighting foam, also called AFFFs.

The team used computer models to identify 20 PFAS compounds from residents' blood samples and then grouped them in categories representing different sources. Some are easy to identify because manufacturers often use a specific type of PFAS. For example, the compounds found in firefighting foam have a unique signature, like a fingerprint, making Peterson Space Force Base the obvious culprit. But more diffuse sources of PFAS, such as those in dust or food, are harder to pin down because scientists aren't sure which PFAS are in them or where they come from.

In North Carolina and Colorado, the sources were more obvious, allowing the research team to test models' ability to identify sources. However, to conduct similar research on a national scale is not so simple. The U.S. Centers for Disease Control and Prevention's National Health and Nutrition Examination Survey has tested levels of PFAS in blood samples nationwide since 1999, but it only tests for a specific list of PFAS, which could overlook the full spectrum of compounds.

Drinking water in both locations in the study shows high levels of fluoroethers and fluoropolymers, many of which are "legacy" PFAS, meaning they have been phased out of production for at least a decade but are still found in drinking water. Because the chemical bonds are so strong, they persist in the environment for years, which is why they show up in blood samples long after companies have stopped using or manufacturing them. Long-chain PFAS like PFOA and PFOS, which are the most-studied compounds with a longer structure of carbon-fluorine bonds, are harder to break down, and they bond to proteins in the blood more easily than short-chain compounds.

"These last a really long time," Wallis said of long-chain PFAS, which were recorded at levels several times higher than national averages. "If you were

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drinking a really high level of it 40 years ago, you would still have really high levels of it 40 years later."

A pollution snapshot

Wallis said they were surprised the models worked because they have never been used for PFAS before. They were built to trace other contaminants in the environment, like particles in air pollution, rather than in people.

Tracing PFAS is more challenging than tracing air pollution for several reasons, Xindi Hu, a lead data scientist at the research organization Mathematica, told EHN. Hu conducted earlier research using a different type of computer analysis of blood samples to identify the main sources of PFAS contamination in the Faroe Islands.

Many PFAS lack distinct chemical fingerprints to tell researchers exactly where a particular compound came from, Hu said. But in the study led by Wallis, the chemical fingerprints from the Space Force base in Colorado and fluorochemical facility in North Carolina are well-known.

"When you take a blood sample, it's really just a snapshot," she said. "So how do you translate this snapshot of concentration back to the course of the entire exposure history?"

That's partly why the new paper's authors conducted this study: The more compounds that are correctly linked to a source, the better these models will work, Wallis said. In essence, they need a better database of PFAS compounds so the models know how to connect the dots.

PFAS also react differently in the human body than in the environment, and scientists still don't fully understand how we metabolize different compounds. Shorter-chain PFAS, for example, are more likely to appear in urine samples than in blood because they are water-soluble, said Pittsburgh's Ng, who studies how PFAS react in humans and wildlife.

"If you're doing everything on the basis of blood levels, it may not tell you everything you need to know about exposure and potential toxicity," she said, adding that PFAS could also accumulate in the liver, brain, lungs and other locations where it's difficult to take samples.

Worse, more modern PFAS with carbon-hydrogen bonds can actually transform into other types of compounds as the body metabolizes them, which could give a false impression of what people are exposed to.

"The key to identifying a good tracer is a molecule that doesn't transform," Ng said. Some PFAS are great tracers, she added, but "the more transformable your PFAS is in general, the poorer the tracer is going to be."

That's why newer PFAS compounds like GenX were not detected in blood samples or used as tracers in the recent study.

"These models aren't going to account for everything," Wallis said. "No model is."

Stopping the contamination

Wallis and their co-authors said they hope the models can become more accurate for less exposed communities in the future. With more data, it would be easier to suggest what to avoid instead of guessing where PFAS exposures come from, Wallis said, adding that it could lead to more protective regulations.

Although these models can vaguely help identify where compounds might come from in a particular community, it's not a definitive solution, Alissa Cordner, an environmental sociologist and co-director of the PFAS Project Lab who was not involved in the recent study, told EHN. Even if there's no immediate application of these methods, identifying where PFAS are is the first step.

"Everybody can point their fingers at other possible sources of contamination," Cordner said. "The best way to address this is not to try to, after the fact, link people's exposure to a contamination source. It's to stop the contamination."

Environmental Health News, 28 November 2022

https://ehn.org

Revolutionary photocatalyst is huge news for green hydrogen and ammonia

2022-11-28

A fundamental breakthrough in chemistry promises to unlock ammonia as a clean fuel, and it could help decarbonize the entire chemical industry in the process. Rice University researchers have created a small, LED-powered device that converts ammonia to hydrogen on the fly. It uses a light-driven catalyst that's as efficient as expensive thermal catalysts that need thousand-degree temperatures to operate, and it's made from cheap,

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abundant copper and iron. And it's only the beginning of a technology that could radically reduce costs and energy use in industrial chemistry.

Hydrogen is a very promising clean fuel that can be burned, or converted directly into electricity through a fuel cell. It's both expensive and difficult to handle, though, since it's a super-lightweight gas that needs to be compressed to 700 atmospheres, or else cryogenically cooled within sight of absolute zero to reach its liquid state.

Ammonia is famously a better hydrogen carrier than hydrogen gas itself; each of its nitrogen atoms binds three hydrogen atoms, and while it's caustic and extremely hazardous in high concentrations, it's a stable liquid at atmospheric temperatures and pressures, and its widespread use in many industries means people have plenty of experience handling it safely under a wide range of conditions.

Ammonia might carry hydrogen exceptionally well, but if you want to use that hydrogen, you need to "crack" it to get the hydrogen out and release the harmless nitrogen back into the atmosphere. This has been difficult for two main reasons: firstly, the reaction is endothermic, so most ammonia cracking is done in large facilities operating at temperatures of at least 650-1,000 °C (1,200-1,800 °F). Secondly, the thermal catalysts required for the cracking operations are typically platinum-group metals like ruthenium – relatively rare and expensive.

With the green hydrogen movement gathering steam as a key pillar of the transition to clean energy, you can see why the Rice University team is excited to have discovered a compact and efficient way to catalyze this cracking reaction at room temperature, using nothing but copper and iron.

It comes down to photocatalytics; this team has been working for more than 30 years to develop its "antenna-reactor" plasmonic photocatalysts. These are nanoparticles of a catalyst, dotted with little clumps of an "antenna" material designed to increase the catalyst's ability to absorb light. Properly tuned, these antenna-reactor particles take in energy from ambient light – be it sunlight, or light from low-energy LEDs – and kick out short-lived "hot electrons" with enough energy to start an efficient chemical reaction even at ambient temperatures.

Antenna-reactor photocatalysts can be designed for all sorts of reactions. This is the same team, and essentially the same underlying idea, behind the light-powered hydrogen sulfide-to-hydrogen catalyst we wrote about a few weeks ago, for example. That one used silicon dioxide as the "reactor"

"This opens the door to entirely replace precious metals in plasmonic photocatalysis."

catalyst, with tiny particles of gold as the "antenna" drawing energy in from light.

This ammonia-splitting photocatalyst uses iron as its reactor, and copper as its light-collecting antenna – both cheap and abundant metals, as opposed to the typical copper-ruthenium thermal catalysts used today. In lab testing, according to Rice alumnus and study co-author Hossein Robatjazi, "under illumination, the copper-iron showed efficiencies and reactivities that were similar to and comparable with those of copper-ruthenium."

The initial tests were conducted using light supplied by lasers, in a tiny experimental setup. But study co-author Naomi Halas is also a co-founder of Syzygy Plasmonics, a well-funded company set up to commercialize the Rice team's work, and Syzygy was able to license this particular catalyst and build a test rig some 500 times larger, using efficient LED lighting instead of lasers. The catalyst remained just as efficient.

"This is the first report in the scientific literature to show that photocatalysis with LEDs can produce gram-scale quantities of hydrogen gas from ammonia," Halas said. "This opens the door to entirely replace precious metals in plasmonic photocatalysis."

So, going back to why we should care about all this, the copper-iron photocatalyst should make it much cheaper and easier to extract hydrogen from ammonia. But it'll also do it without needing heat, so there'll be energy and emissions saved as well.

Perhaps most importantly, this looks like it'll lead to an ammonia cracking device that's small, reliable, lightweight, and cool rather than running at hundreds of degrees. Something that doesn't need a full-scale facility to operate. Syzygy says its initial Rigel Photocatlytic Reactor product is about the size of a small washing machine, and processes around a ton a day, depending on the specific reaction it's running. These can be stacked; you can run a bunch of them simultaneously if you need a greater output.

Perhaps you could stick a bank of these on an electric cargo ship, converting easily-stored ammonia into easily-used hydrogen right where it's needed. That in itself could be absolutely revolutionary, radically boosting the range of clean cargo and passenger shipping.

Perhaps the concept might prove small and light enough to be relevant in aviation, where the energy density of hydrogen stored in ammonia could open up range figures that are currently out of reach without jet fuel.

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Perhaps it might eventually be small enough to stick in an electric car you can fill up with ammonia at a gas station.

And that's just this particular photocatalyst; the Rice and Syzygy teams are certainly not stopping here. Indeed, the company's target is to put thermal catalysts out of a job wherever they can.

"Given their potential for significantly reducing chemical sector carbon emissions, plasmonic antenna-reactor photocatalysts are worthy of further study," added another co-author, Emily Carter. "These results are a great motivator. They suggest it is likely that other combinations of abundant metals could be used as cost-effective catalysts for a wide range of chemical reactions."

"Catalysis is the foundation of chemical industry," says yet another co-author and Syzygy co-founder Peter Nordlander, "and it's one of the most energy-consuming parts of all society."

"We show in this work," adds Halas, "that LED-based chemistry is actually doable, and it's doable at scale. It can contribute to industrial-scale chemistry, and industrially-important reactions."

Syzygy says it's already got this reaction up and running in field trials, and that it expects to have these photocatalytic ammonia-cracking reactors commercially available in 2023.

This is some very exciting technology, with huge potential across a range of industries and as a contributor to decarbonization. Learn more in the video below.

New Atlas, 28 November 2022

https://newatlas.com

New Banana-Derived Therapy Is Effective Against All Known Coronaviruses and Flu Strains

2022-11-29

A study published on January 13th, 2020 touted the development of a potential therapy that may be used to fight all known strains of the flu.

One week later, the first laboratory-confirmed case of SARS-CoV-2 triggered the two-and-a-half-year-long COVID-19 pandemic in the United States.

According to the researchers, the therapy, H84T-BanLec, holds unique promise. They hope to start human testing soon.

Interestingly, the worldwide research team behind the influenza report had also looked into the treatment of coronaviruses before the virus that temporarily halted their work arrived.

"At the time we thought MERS would be the big target, which we were worried about because of its 35% mortality rate," said David Markovitz, M.D., professor of internal medicine, Division of Infectious Diseases at the University of Michigan Medical School. (MERS, or Middle Eastern Respiratory Syndrome, caused a brief outbreak in 2015 and resulted in 858 confirmed deaths.)

A study published in Cell Reports Medicine describes the effectiveness of H84T-BanLec against every coronavirus known to infect humans, including MERS, the original SARS, and SARS-CoV2, including the omicron variant. Markovitz is joined by two senior authors: Peter Hinterdorfer, Ph.D., of the Institute of Biophysics at Johannes Kepler University, and Kwok-Yung Yuen, MBBS, M.D., of the University of Hong Kong. Jasper Fuk-Woo Chan, M.D., of the University of Hong Kong, is the paper's first author.

"When COVID-19 occurred, we of course wanted to study the therapy's potential and discovered it was effective against every type of coronavirus, in vitro and in vivo," Markovitz said. "Whether delivered systemically or through the nose in animal models or prophylactically or therapeutically early on in the illness, it worked."

H84T-BanLec is derived from a lectin (a carbohydrate-binding protein) isolated from banana fruit. It accomplishes its remarkable viral-blocking abilities by binding to high-mannose glycans, polysaccharides that are present on the surface of the viruses, but only very rarely on normal healthy human cells. After binding, the virus cannot enter cells to infect them.

Using atomic force microscopy and related methods, the team confirmed that H84T develops multiple strong bonds with the spike protein, which, said Markovitz, probably explains why it's hard for a coronavirus to be resistant to the lectin.

Despite their anti-viral potential, lectins have traditionally been avoided as possible therapies because they are proteins that can stimulate the immune system in a potentially harmful way, explains Markovitz. However, H84T-BanLec has been modified to remove this effect and showed no detrimental effects in the animal models.

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While several treatments for COVID-19 currently exist, including remdesivir, Paxlovid, and monoclonal antibodies, they have varying levels of effectiveness, side effects, and ease of use and many have proven less effective as SARS-CoV2 continues to evolve.

H84T-BanLec holds unique promise, according to the team, because it is effective against all coronavirus variants as well as influenza viruses. Markovitz and the team hope to see the therapy take the more difficult step from animal model to testing in humans. The team envisions a nasal spray or drops that can be used to prevent or treat coronavirus and influenza infections in seasonal and pandemic situations. They also hope to examine using H84T-BanLec against cancer—as cancer cells, like viruses, also have high mannose glycans on their surfaces.

Sci Tech Daily, 29 November 2022

https://scitechdaily.com

Future vehicles could swim like gelatinous sea creatures

2022-11-29

A gelatinous sea creature's swimming abilities could inform the design of underwater vehicles.

Nanomia bijuga, a marine animal related to jellyfish, swims via jet propulsion. A dozen or more squishy structures on its body pump water backwards to push the animal forward. And it can control these jets individually, either syncing them up or pulsing them in sequence.

These two different swimming styles let the animal prioritize speed or energy efficiency, depending on its current needs, researchers find.

Marine biologist Kelly Sutherland and postdoctoral researcher Kevin Du Clos of the University of Oregon and colleagues report their findings in the Proceedings of the National Academy of Sciences.

"Most animals can either move quickly or in a way that's energetically efficient, but not both," says Sutherland. "Having many, distributed propulsion units allows Nanomia to be both fast and efficient. And, remarkably, they do this without having a centralized nervous system to control the different behaviors."

Nanomia shares the gelatinous, ethereal form of its jellyfish relatives. But it's a little more structurally complicated: Each one is technically a colony of individuals. For instance, each of Nanomia's jets is produced by an individual unit called a nectophore. The nectophores are clustered on a stalk-like structure at the front of the animal. Meanwhile, wispy tentacles

trail behind, carrying structures specialized for feeding, reproduction, and protection.

While many marine creatures move via jet propulsion, squid and jellyfish included, most just have one jet. Nanomia often has ten to twenty—the exact number varies colony-to-colony.

"We're interested in why multi-jet swimming is useful, and what we were really interested in here was the timing," Du Clos says. Nanomia can pulse its nectophores all at once, or activate them in a sequence. Du Clos and his colleagues wanted to see how those different modes impacted the animals' swimming style, possibly illuminating an evolutionary advantage to having multiple jets.

At Friday Harbor Labs in Washington, the researchers scooped Nanomia out of the ocean and put them in tanks in the lab. Then, they used video recordings and computer models to analyze the swimming patterns. The two different swimming modes are suited to different situations, the team found.

Synchronous pulsing sends Nanomia forward very quickly—perfect for a speedy escape from a predator. Asynchronous pulsing moves the animal a little more slowly, but more steadily, and the researchers' modeling experiments suggested that it's a more energy-efficient way to swim. So with Nanomia sometimes traveling hundreds of meters per day, asynchronous pumping might be better suited for everyday use.

The intricacies of Nanomia's movement could be useful for engineers turning to nature for inspiration.

"It gives a framework for developing a robot that has a range of capabilities," Du Clos says. For instance, an underwater vehicle could have multiple propulsors, and simple changes in propulsion timing could allow that one vehicle to move either quickly or efficiently as the need arises.

In future work, the researchers plan to dive more into Nanomia's features, next focusing on better understanding how the arrangement of the animal's tentacles affects its feeding.

Colonial animals are quite common in the open sea due to their potential hydrodynamic advantages, Sutherland adds. The team is currently looking beyond Nanomia at other species of colonial swimmers, to figure out how diverse arrangements of swimming units influence animals' movement.

Futurity, 29 November 2022

https://futurity.org

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Plastic pollution: Three problems that a global treaty could solve

2022-11-28

Plastic is one of the fastest growing materials and production is on course to double, to more than one billion tonnes a year, by 2050. With that, will come more pollution. This week, delegates from more than 150 countries are expected to meet in Uruguay to begin negotiations for a historic global agreement to end plastic pollution.

In March, the United Nations Environment Assembly made a landmark decision to create a legally binding treaty that considers the lifecycle of plastics, from production through to innovative packaging, products and business models.

The treaty is expected to be finalized by the end of 2024. Between now and then, negotiators will have the daunting task of devising and agreeing to rules and strategies for controlling plastic pollution. Nature explores three key issues and how the treaty could tackle them.

Pollution

Plastic accounts for 85% of all marine litter. The UN Environment Programme (UNEP) predicts that the amount of plastic in the ocean will nearly triple by 2040, adding 23 million to 37 million tonnes more waste every year.

"The vast majority of mismanaged plastic waste that originates on land eventually ends up in rivers and is churned out into oceans," says Steve Fletcher, who studies ocean policy and economy at the University of Portsmouth, UK, and works with UNEP on plastic issues.

The cost of plastic pollution to society — including environmental clean-up and ecosystem degradation — exceeds US$100 billion a year, according to the philanthropic Minderoo Foundation in Perth, Australia. "The cost of inaction against plastic waste far exceeds the cost of addressing plastics", says Linda Godfrey, a principal scientist at the Council for Scientific and Industrial Research in Pretoria, South Africa.

Specialists discuss strategies that could help stop plastics contaminating the environment.

Godfrey says that treaty negotiators will have to deal with competing opinions about how to resolve pollution: non-governmental organizations and lobbyists often want to ban single-use plastics and find safer alternatives; the plastics industry says that pollution can be solved through improved waste collection; and the waste-management and recycling industries push for more recycling. "There is no silver-bullet solution," she says. Godfrey hopes that the treaty will include all of these measures, with varying degrees from country to country. Banning the movement of plastic waste from high-income countries to lower-income countries will also reduce pollution, she says.

Godfrey also wants the treaty to specify that producers pay for the collection, sorting and recycling of the plastic packaging and products they make. This would divert more plastic from landfill and shift the financial burden of waste management away from local governments, which are typically funded by taxes. If companies making and using plastic can't afford to do this, then, "should this product be on the market, and should it be in plastic?", she asks.

To reduce the amount of plastic ending up in the ocean, the treaty must include a deadline by which countries aim to reduce the amount of plastic they use, says Atsuhiko Isobe, an oceanographer at Kyushu University in Fukuoka, Japan.

Recycling

Currently only 9% of plastic waste is recycled, in part because plastic waste has little value. Scientists say that if it was worth something, more plastic would be reused, less would end up in the environment and there would be less need for new plastics, a concept called the circular economy.

To jump-start a circular economy for plastic, Australian mining billionaire and philanthropist Andrew Forrest thinks that countries should agree, as part of the treaty, to place a surcharge on the creation of polymers, the building blocks of plastics. This money could be used to fund recycling.

Retailers that sell plastic products should also be obliged to buy back plastic waste and find ways to reuse it, says Forrest, who chairs the Minderoo Foundation, which runs an initiative to accelerate the creation of a circular economy. This cost for retailers would probably be passed on to consumers, but Forrest thinks that consumers would be willing to pay more for products if they knew this would reduce the amount of plastics in the environment. Such an approach would also help end the production

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of plastics that cannot be reused or recycled, because there would be no one to buy them back.

Forrest wants the treaty to establish such a system in the next five years, with countries introducing regulations that penalize companies that pollute plastic into the environment. "Major manufacturers and distributors of plastic have all admitted to me that they give consumers no choice but to consume plastic which cannot be recycled," says Forrest. "With penalty-backed regulation, you will see companies change their habits immediately."

But Godfrey wonders whether a circular economy is desirable, particularly because little is known about the health risks posed by plastics that have been recycled several times. "As we drive greater plastic circularity, we need to ensure we're not increasing the risk to human or to ecosystem health," she says.

Social and health implications

All over the world, but mainly in Asia, plastic waste is burnt. This reduces the volume of waste and prevents it from becoming breeding grounds for bacteria, viruses and mosquitos. But the burning is a major contributor to air pollution, says Cressida Bowyer, a biologist at the University of Portsmouth, who works on creative approaches to address plastic pollution.

Around 4.2 million people died as a result of outdoor air pollution in 2016, with 91% of those deaths in low- and middle-income countries. In low-income parts of Nairobi and Sylhet, a city in Bangladesh, plastic is part of the landscape and presents a substantial health hazard. "It's physically embedded into the soil," making it extremely difficult, if not impossible, to collect back, Bowyer says. She wants the treaty to consider alternatives to plastic.

Studies have found that microplastics are inhaled1 and consumed through food and water2. Smaller-sized plastics, called nanoplastics, have also been shown to cause damage and inflammation in human skin and lung cells. Plastics also contain additives — such as bisphenol A, phthalates and polychlorinated biphenyls — that are linked to endocrine disruption and reproductive abnormalities3,4.

"We're just beginning to take the lid off that the Pandora's box to find out how much plastic — and its associated chemicals — are in us," says

neuroscientist Sarah Dunlop, director of plastics and human health at the Minderoo Foundation.

Dunlop says that the treaty should consider asking countries to ban or phase out chemicals in plastic that are known to harm human health. "The treaty needs to include protecting human health through chemical regulation as well as other measures," she says.

Nature, 28 November 2022

https://nature.com

The Laws of Thermodynamics Will Not Bend for Landfills

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You handle waste every day. Tissues. Bottles and cans. Kitchen scraps, maybe yard trimmings. And plastics. So many plastics. The wet, the dry, the smelly, and the disgusting.

But the stuff you personally put in this or that bin is the tiniest part of all the waste that arises in the United States and other countries whose economies are premised on mass consumption. Although numbers are tricky here, something like 97 percent of all waste arising in the United States happens before you—as citizen and consumer—buy, use, and toss the things you need and want for your daily life. If you live in a typical American city, all the garbage and recycling you see getting picked up at the curb is just that remaining 3 percent of overall waste arising.

In Palmer Holton's story, a fictional company called Universal Waste promises to solve all this. Universal Waste's marketeers claim the company will bring wealth and prosperity to Claremont, Kansas, by turning the local landfill into its opposite, a mine. The company wants to extract precious metals scattered in the landfill from generations of consumer discards interred in its bowels. But as much as the citizens of Claremont hope that renewed economic development can be reanimated from the landfill-now-mine, it turns out to be too good to be true.

So are the promises of Universal Waste's real-world analogs. Today, companies promise that waste can, almost like magic, be converted back into treasure—methane from landfills turned into energy that reduces the "average carbon intensity" (but not total carbon) of major oil and gas firms; "500 kilotons" of plastics recycled back in to their chemicals. (That's not even 1 percent of annual new plastics production in the U.S.)

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Trash to treasure is a trick. It glosses over fundamental problems relating to the technical inability to overcome some physical limits. It also obscures the reality that real-world waste management companies are finding ways to turn wastes into financial assets. Doing so enriches themselves and their shareholders, but neither offers much in the way of benefits to the communities that host their facilities nor does anything to stem the flow of waste.

The laws of thermodynamics haunt dreams of a circular economy. It is not possible to recycle energy continually without a loss in its quality or density. That's the second law of thermodynamics in action. No recycling plant can be run solely off of the excess heat of another such recycling plant. A landfill might concentrate materials and the energy they embody into a compact location. But it simply cannot contain the energy necessary to excavate, reprocess all the materials the company wants, and separate out the materials it doesn't. Finding a way around this thermodynamic conundrum would truly require a Copernican revolution in our understanding of physics. That's not necessarily impossible, but probably improbable.

The stuff going into contemporary landfills is very different than their historical precedents. This "modern waste," as Samantha MacBride, an assistant professor at Baruch College, calls this jumble of materials, is notable for its heterogeneity, toxicity, and tonnage. This material complexity makes recovery difficult, and efficiency isn't the only issue. Some amalgams of materials, such as plastics and certain combinations of metals, are technically impossible to separate back into their constituent materials (at least for now). No matter how much effort would be applied there are no technologies on the horizon that can achieve that kind of separation, so some amount of materials and energy will always be lost (back to thermodynamics again).

As my fellow geographer Nicky Gregson, an emerita professor at Durham University, shows in her forthcoming book, interesting things happen when, instead of waste, we start with the question of valuation. Universal Waste, the fictional company, does what many actual companies are doing today: turn discarded products and materials in landfills back into assets, as things that can be re-harvested, traded, and speculated on (e.g., for reuse in industrial manufacturing or incinerated as fuel for waste-to-energy facilities). Yet, as the decaying human remains found in Claremont's landfill of Holton's story reminds readers, this transmutation of waste into financial value involves a dark alchemy. That trick relies on incalculable losses that can be externalized from the financial arithmetic, but not from

the world itself. Outside the formal calculations of financialized assets, waste, pollution, trash, and their harmful effects persist. Landfill materials mined for reuse require additional inputs of materials and energy to be turned back into products. Incinerating them for energy generation adds to the atmospheric burden of carbon dioxide and other airborne toxicants. By these measures, Earth already is a circular economy, although not necessarily in a way one would hope.

If you came home one day to find your bathroom overflowing because you mistakenly left the bathtub running you might run madly about searching for a mop with which you could soak up the water spilling over the brim. A better response, of course, would be to turn off the tap and stop the flow of water. Landfills are kind of like that overflowing tub; they can absorb a certain amount of material flowing into them, but not indefinitely. Unlike a bathtub, there is neither a single faucet to turn off, nor a plug to unplug that would drain the tub to some other ultimate sink. At best, landfills temporarily sequester some of the cast-offs of industrial production and consumption but they will, eventually, overflow, leak, and/or spill.

If we arrange our economic systems such that they are premised on continual growth in the sense of an increasing aggregate of materials and energy flowing into them, wastes will inevitably arise. Like a bathtub, those systems are already overflowing. So far as we know, we can't dodge thermodynamics. But we may be able to devise ways to work more collaboratively with them. Part of that collaboration will mean figuring out how to live without growth in the aggregate. That's not an argument for living in burlap sacks and chewing on local root vegetables, but it does mean rearranging and reinventing the interlocking systems that make our different daily lives possible.

Rather than a singular monolithic solution, it's important to think about a portfolio of options. Among those options is increasing efficiency, that is, using less and less materials and energy per thing produced. But that will only get us so far. As the English political economist William Stanley Jevons found out more than a century ago, the more efficient things become, the cheaper they get, and the more people can afford them. Eventually, that increased demand swamps the earlier gains in efficiency as aggregate demand for energy and materials increases. Decoupling of growth from energy and material throughput, seems, at best, only partially possible and even then only in certain subsectors of the overall economy (e.g., data centers).

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So while efficiency can help, it shouldn't be pursued as an end in itself. We also need to reduce the material complexity and toxicity of the products we make and use. Doing so would make them easier to take apart and reuse the materials of which they're made. But we also need to think about how to manage the shrinkage of some industries just as we manage the growth of others until they provide us with a sufficient stock of different infrastructure for living in ways that mean less toxic and less voluminous wastes arise.

There is no single way this all has to happen. Some options are already on the table. One possibility dubbed cosmolocalism points to a world in which ideas for products circulate in a global digital commons, but the actual manufacturing happens at or near the site of consumption. Such a "design global, manufacture local" system is increasingly possible for all sorts of things, such as furniture, tools, and toys.

Libraries offer another example of an existing arrangement where things people want are held in common and lent out as desires arise. This is a familiar situation for books, but is also a model being shifted to many other things. For instance, instead of every person or household owning their own drill, for example, and using it for a matter of mere minutes over its typical life, you could borrow one from your library. Making products accessible this way allows a smaller number of high-quality products to be made and shared instead of a mass of lower quality but cheaper products owned by many. A library approach to things could substantially reduce aggregate demand for energy and materials without inherently leading to scarcity of access to things.

Today, waste management is a global, multibillion dollar industry. The business model is generally premised on treatment, disposal, and incineration (sometimes for energy generation). Whatever one might think about such a business model, there's one thing for sure it doesn't do: reduce waste. Imagine a waste management firm actively trying to reduce the garbage for which it contracts its services to manage. Imagine a private landfill owner actively discouraging customers for the disposal space that company sells access to. Status quo waste management is just like status quo industrialism. It is premised on growth. Yet, unchecked growth can lead to system collapse.

Holton's story is a meditation on collapsing systems and the existential dread felt by those for whom those systems offered at least a partial sense of safety and security. It's not a coincidence that the story's protagonist is a police detective—a public servant tasked with putting people, places, and

things in order when they threaten the status quo. The story is premised on one of the great prompts for science fiction storytelling: "If this keeps up …" But the dread Holton captures is hardly a universal human experience when it comes to waste or the apocalyptic collapse of systems it represents to some people. Other ways of organizing landfills and the systems of which they are part are possible. Imagine a world in which more of the things we need and want for everyday lives are borrowed, not bought. Where more of those things are made mostly where we live, work, and play. Would such a world be strange? Perhaps. But if so, that is only to think with one of the other great prompts for science fiction: What if?

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