CHEMWATCH

Bulletin Board

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ASIA PACIFIC

Hydrogen cyanamide reassessment

2023-03-06

We are reassessing the use of hydrogen cyanamide, a restricted spray ingredient used in commercial orchards.

Hydrogen cyanamide has been used in Aotearoa New Zealand since 1988. It is used mainly in kiwifruit orchards to promote bud growth. It is also used in some apple, cherry, apricot, and kiwiberry crops, but to a lesser extent.

There are six hydrogen cyanamide products approved for use. They are restricted to commercial use and can only be used by trained professionals.

Latest application update

21 February 2023

The Decision-making Committee has decided to postpone the hearing currently set for 6 March due to the significant impacts of Cyclone Gabrielle on the upper North Island. A new date for the hearing will be published in a future Direction and Minute.

Read Direction and Minute WGT016 (PDF, 139KB)

31 January 2023

We have published a Social Impact Assessment report. The decision-making committee requested this independent report to gain a better understanding of the current social impacts of hydrogen cyanamide use and potential social impacts if hydrogen cyanamide was no longer available.

The decision-making committee will consider this report, alongside other information provided throughout the reassessment process, in making its decision.

Read the Social Impact Assessment (PDF, 345KB)

14 December 2022

We have published the EPA update report with our revised proposals and accompanying updates to the human health risk assessment, environmental risk assessment, and economic benefits risk assessment.

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The recommendations in the update report may or may not be supported by the decision-making committee. It is one of many information sources considered in the decision-making process.

Read the update report (PDF, 500KB)

Read More

EPA New Zealand, 06-03-23

https://www.epa.govt.nz/public-consultations/in-progress/hydrogen-cyanamide-reassessment/

China Consulting on Amendments to Two Mandatory National Standards on Dangerous Goods

2023-03-21

On March 1, 2023, the National Public Service Platform for Standards Information in China released two draft national standards – GB 6944 Classification and Code of Dangerous Goods and GB 12268 List of Dangerous Goods. The two drafts are open for public consultation until May 8, 2023.

You can check details on the national standards and submit comments via the following link:

https://std.samr.gov.cn/gb/search/gbqSuggestionDetail?id=23415AF97EB2D0633DF3D38AF8845B9E

GB 12268 List of Dangerous Goods

The revised GB 12268 will replace GB 12268-2012. Compared with the current version, the revised standard aligns with the Recommendations on the Transport of Dangerous Goods Model Regulations (Rev.22) as well as other regulations and technical standards on the transport of dangerous by road, rail, air, or water (marine).

Major technical changes are as follows:

- The classification and code of dangerous goods has revised (see sections 4.1 of GB 12268, or 4.1, 4.2, and 4.4 of GB 12268-2012);
- The description of the scope of dangerous goods listed in the List of dangerous goods has been supplemented (see section 4.2);
- 59 dangerous goods (UN0510-UN0513 and UN 3496-UN 3550) were added (see Table 2 of GB 12268, or Table 1 of GB 12268-2012);

- The Structure of the dangerous goods list has been modified:
- Column (6) is changed to "UN packing group";
- Column (8) "limited quantities" has been added;
- Column (9) "Excepted quantities" has been added;
- Column (10) "Packing instructions" has been added;
- Column (11) "Special packing provisions" has been added;
- Column (12) "Portable tank and bulk container instructions" has been added; and
- Column (13) "Special provisions on portable tank and bulk containers" has been added.

Read More

CIRS, 21-03-23

https://www.cirs-group.com/en/chemicals/china-to-make-amendments-to-two-mandatory-national-standards-on-dangerous-goods

Chemicals added to the Inventory 5 years after issue of assessment certificate – 23 March 2023

2023-03-23

The following industrial chemicals have been added to the Australian Inventory of Industrial Chemicals in accordance with section 82 of the Industrial Chemicals Act 2019 because 5 years have passed since the assessment certificates for the industrial chemicals were issued.

A list of chemicals added to the Inventory 5 years after issue of assessment certificate

CAS Number	2894096-45-6
Chemical Name	1,12-Dodecanediol, polymer with 1,6-diisocyanato-2,2,4-trimethylhexane, 1,6-diisocyanato-2,4,4-trimethylhexane and .alpha.-hydro-.omega.-hydroxypoly(oxy-1,2-ethanediyl), C10-18-alcs.-blocked
Molecular Formula	Unspecified

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CAS Number	2894096-45-6
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	6 March 2023

CAS Number	2894096-46-7
Chemical Name	1,2-Dodecanediol, polymer with .alpha.-hydro-.omega.-hydroxypoly(oxy-1,2-ethanediyl) and 1,1'-methylenebis[4-isocyanatocyclohexane], isotridecanol-blocked
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	6 March 2023

CAS Number	195074-23-8
Chemical Name	1,3-Propanediol, 2-butyl-2-ethyl-, polymer with 5-isocyanato-1-(isocyanatomethyl)-1,3,3-trimethylcyclohexane
Molecular Formula	(C12H18N2O2.C9H20O2)x
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	6 March 2023

Read More

AICIS, 23-03-23

https://www.industrialchemicals.gov.au/news-and-notices/chemicals-added-inventory-5-years-after-issue-assessment-certificate-23-march-2023

AMERICA

FDA Issues Final FSMA Guidance

2023-03-06

On January 11, 2023, the U.S. Food and Drug Administration (FDA) announced the availability of a final guidance for industry titled "Foreign Supplier Verification Programs for Importers of Food for Humans and Animals: Guidance for Industry." 88 Fed. Reg. 1503. The guidance provides FDA's thinking on how importers of food for humans and animals can comply with the Food Safety Modernization Act (FSMA) regulation on foreign supplier verification programs (FSVP) issued by FDA on November 27, 2015. 80 Fed. Reg. 74225.

Read More

JDSupra, 06-03-23

https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-2408877/

US finally set for nationwide regulation of PFAS in drinking water

2023-03-17

The US Environmental Protection Agency (EPA) has proposed the first-ever nationwide drinking water standards in America for six members of a controversial class of chemicals known as per- and polyfluoroalkyl substances (PFAS). The agency anticipates finalising the regulation by the end of the year.

PFAS chemicals have unique properties that confer oil, grease and water repellence as well as resistance to high temperatures, which have led them to be used in the production of household items like non-stick cookware, raincoats, as well as in furniture as fabric protectors. But they do not degrade in the environment, are highly mobile and bioaccumulate.

The EPA will set limits for six PFAS, including perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), which are two of the best known and studied of the estimated 12,000 PFAS compounds out there. They have been linked to health problems like high cholesterol, liver damage, immune system impairment, as well as fertility problems and cancer.

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Chemistry World, 17-03-23

https://www.chemistryworld.com/news/us-finally-set-for-nationwide-regulation-of-pfas-in-drinking-water/4017151.article

FDA Launches "Into The Dataverse" Video Series

2023-03-06

On January 13, 2023, FDA released the first video in a series named "Into the Dataverse." This video provides an overview of 21 Forward, a data analytics tool that makes the food supply chain more transparent to FDA, enabling the agency to anticipate potential problems and manage those risks before they have real-world implications. 21 Forward is a real-world example of data modernization fueling the future of food safety. This platform is part of FDA's modernization goals through its New Era of Smarter Food Safety initiative.

Read More

JDSupra, 06-03-23

https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-2408877/

FDA Posts Translations For FSMA Rule

2023-03-06

On January 19, 2023, FDA announced the posting of translated materials for the FSMA final rule on food traceability, which are now available in Indonesian, Simplified Chinese, Spanish, Thai, and Vietnamese.

Read More

JDSupra, 06-03-23

https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-2408877/

FDA Re-releases 2022 Edition Of FDA Food Code

2023-03-06

On January 20, 2023, FDA announced the posting of the updated 2022 Food Code to include correction of formatting errors. A new job aid was also released for food establishments and regulators.

Read More

JDSupra, 06-03-23

https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-2408877/

Congress Enacts Modernization Of Cosmetics Regulation Act Of 2022, Significantly Strengthening Regulation Of Cosmetics

2023-03-06

In a move that some may not have seen coming, Congress enacted the Modernization of Cosmetics Regulation Act of 2022 (MCRA) on December 29, 2022, as part of the Omnibus Appropriations Act. The MCRA significantly strengthens the FDA authority over cosmetic products. Key impacts are summarized in our January 18, 2023, memorandum.

Read More

JDSupra, 06-03-23

https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-2408877/

OSHA Revises Combustible Dust NEP

2023-03-06

On January 27, 2023, the Occupational Safety and Health Administration (OSHA) announced that it issued a revised Combustible Dust National Emphasis Program (NEP). OSHA notes that any combustible material can burn rapidly when in a finely divided form, and if such a dust is suspended in air in the right concentration, under certain conditions, it can become explosible. The purpose of the revised NEP is to continue OSHA inspections of facilities that generate or handle combustible dusts likely to cause fire, flash fire, deflagration, and explosion hazards. According to OSHA, incident reports indicate that the majority of the industries involved in combustible dust hazards are wood processing, agricultural and food production, and lumber production, but others are susceptible as well. OSHA states that it added the following industries to the NEP because they have a higher likelihood of having combustible dust hazards or experienced combustible dust-related fatalities/catastrophes:

- 311812 - Commercial Bakeries;

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- 325910 - Printing Ink Manufacturing;
- 321912 - Cut Stock, Resawing Lumber, and Planning;
- 316110 - Leather and Hide Tanning and Finishing;
- 321214 - Truss Manufacturing; and
- 424510 - Grain and Field Bean Merchant Wholesalers.

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JDSupra, 06-03-23

https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-2408877/

EUROPE

Safety Gate: chemical substances top the annual list of health hazards for non-food products

2023-03-13

Today, the European Commission published its annual report on the Safety Gate, the European Rapid Alert System for dangerous non-food products. The report covers alerts notified during 2022, and the responses given by national authorities. Health risks linked to chemical substances was the most frequent type of risk notified, which was found also in a wider variety of products. For the second consecutive year, toys and cars top the list of most notified product categories.

Main findings of the report

In 2022, authorities from the 30 participating countries of the Safety Gate network (EU Member States, Norway, Iceland and Liechtenstein) reacted to 2,117 alerts with 3,932 follow-up actions. In every Member State, market surveillance authorities followed up on the alerts regularly and exchanged additional information. 84% of follow-up actions included additional national measures. For example, the Austrian market surveillance authorities detected a toy containing easily detachable parts, which presented a choking risk for children. Following notification from the Austrian authorities on Safety Gate, the Slovenian authorities identified the toy on their market, and retailers were able to swiftly recall the product.

In 2022, risks related to chemical substances, injuries and choking were the most notified. The list of most common product categories notified

was topped by toys, followed by motor vehicles, cosmetics, clothing, and electrical appliances. Last year, cosmetic products had a significantly higher number of alerts related to the presence of recently banned chemical substances in perfumes and creams.

However, the sharp rise of alerts related to chemical risks was not only due to cosmetics, as chemical risks were identified in a wider range of products. Certain toys, for example, had an excessive concentration of phthalates, which poses risks to the reproductive system.

Read More

European Commission, 13-03-23

https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1608

WRAP sets targets for removing single-use packaging in store-sold produce

2023-03-22

UK-based organization publishes roadmap to reducing food waste and single-use plastic packaging; targets selling 50% of fruits and vegetables loose by 2030; aims to support retailers and other stakeholders in reaching UK Plastics Pact targets.

On March 15, 2023, the UK NGO Waste and Resources Action Programme (WRAP) released a report detailing a pathway to remove packaging from uncut fresh produce. The document aims to reduce food waste and greenhouse gas emissions by removing unnecessary plastic packaging, in line with the Courtauld Commitment 2030, the World Wide Fund for Nature's (WWF's) Basket, and the UK Plastics Pact (FPF reported).

According to earlier research published by WRAP in February 2022, "70,000 tonnes of plastic are used to package uncut fruit and veg each year. If all apples, bananas and potatoes were sold loose, 60,000 tonnes of food waste could be saved." The report outlines key principles for retailers to follow, as they head towards selling more loose uncut fruits and vegetables, and it presents yearly minimum targets to reach up to 2030. The authors suggest a selection of the key produce that should be prioritized, including apples, broccoli, peppers, and eggplant among many others. They also state that the loose versions should be priced comparably to the packed alternatives, making the option as attractive as possible for consumers. By the end of 2030, "the aim is for 50% of uncut fresh produce sales volume (units/kgs) in store […] to be loose." According

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to WRAP's Retail Survey for the year 2021/22, that number is currently at just 20%. WRAP will publish this survey annually to report on progress towards reaching the 50% target.

Read More

Food Packaging Forum, 22-03-23

https://www.foodpackagingforum.org/news/wrap-sets-targets-for-removing-single-use-packaging-in-store-sold-produce

Fragrance makers under investigation

2023-03-16

The European Commission has begun investigating fragrance ingredient manufacturers for possible anticompetitive practices that could hurt buyers of their products. The EC, along with authorities in Switzerland and the UK, carried out raids on March 7 to collect evidence at the premises of some of Europe's biggest fragrance ingredient firms. The US Department of Justice's Antitrust Division is also involved in the probe.

In addition to the raids, the EC says it has sent formal requests for information to several companies in the sector. International Flavors & Fragrances, Firmenich, Givaudan, and Symrise have confirmed to C&EN that they are part of the investigation, and all say they are cooperating fully with authorities.

The Swiss competition commission says it "has indications that several undertakings active in the production of fragrances have violated cartel law." It adds that "there are suspicions that these undertakings have coordinated their pricing policy, prohibited their competitors from supplying certain customers and limited the production of certain fragrances." Swiss authorities say they will examine whether competition in the fragrance sector has been restricted in ways prohibited by cartel law.

Read More

C&N, 16-03-23

https://cen.acs.org/business/specialty-chemicals/Fragrance-makes-under-investigation/101/web/2023/03

UK Consults Over Proposed Revision to Persistent Organic Pollutants

2023-03-17

The UK has launched a consultation on potential revisions to the Persistent Organic Pollutants (POPs) Regulation. Comments are accepted until April 27, 2023.

On March 2, 2023, the United Kingdom's (UK) Department for Environment, Food and Rural Affairs (DEFRA) launched a consultation on its proposed changes to retained Regulation (EU) 2019/2012 as amended by the Persistent Organic Pollutants (Amendment) (EU Exit) Regulations 2020/1358 and the Persistent Organic Pollutants (Amendment) (EU Exit) Regulations 2022/1293 (the 'Persistent Organic Pollutants (POPs) Regulation').

The proposed revisions are related to changes to the Stockholm Convention which the UK, as party to the Convention, must implement. Other proposed changes stem from the 2022 review of the POPs Regulation, or are in response to scientific or technical progress. These include revising Annexes I, IV and V to the POPs Regulation and two intended amendments involving four substances.

Read More

SGS, 17-03-23

https://www.sgs.com/en-ae/news/2023/03/safeguards-3623-uk-consults-over-proposed-revision-to-persistent-organic-pollutants

INTERNATIONAL

Reports on substitution of chemicals of concern – an overview

2023-03-23

On March 7, 2023, the Organisation for Economic Co-operation and Development (OECD) published three reports on the substitution of chemicals of concern. The reports focus on cross-country analysis of alternatives assessment and substitution, third-party approaches, and economic incentives. The reports update and build upon the work published in January 2019 (FPF reported). The OECD reports summarize how a multi-method approach composed of regulatory and voluntary elements is most effective in supporting the substitution of chemicals of concern.

Regulations are crucial in restricting the use of certain chemicals, and the voluntary approaches aim to encourage needed dialogue amongst stakeholders, exchanging information and key learnings. According to the report, third-party organizations, i.e., NGOs or academic institutions are necessary to make advancements in the field by imparting technical assistance, knowledge, and training to a variety of audiences.

The authors identify critical hurdles in assisting the substitution of chemicals of concern. While efforts are made in creating dialogues, these efforts need to be sustained and improved further by governments, industry, trade unions, NGOs, and the public. "Communication was pointed out as one of the best means to help address the complexity of substitution practices (in particular trade-offs) and the "fear of the unknown" when industry engages in substitution." Other challenges include the need for support in filling data gaps, promoting transparency along the supply chain, and science-based governance that is consistent and predictable.

Read More

Food Packaging Forum, 23-03-23

https://www.foodpackagingforum.org/news/reports-on-substitution-of-chemicals-of-concern-an-overview

Report outlines how plastic production harms human health, environment, economy

2023-03-21

On March 21, 2023, the Minderoo-Monaco Commission on Plastics and Human Health published a report in the Annals of Global Health summarizing impacts from all stages of the plastics supply chain on human health, environmental health, and the economy. With over 10,000 substances known to be used intentionally in plastic products (FPF reported) the report authors focus on the effects from five widely studied chemical groups, specifically: phthalates, bisphenols, per- and polyfluoroalkyl substances (PFAS), brominated flame retardants, and organophosphate flame retardant. Further, they provide information on the growing evidence of effects from micro– and nanoplastics.

Minderoo-Monaco Commission on Plastics and Human Health publishes extensive report summarizing plastics' effects across life cycle on human health, environment, and the economy.

The human health section gives particular attention to vulnerable populations such as developing fetuses and young children, and those working in and living near manufacturing facilities (FPF reported). Highlighted effects include a 30% increased rate of leukemia in neighboring communities as well as increased rates of breast cancer among men and women working in plastics production facilities with women more than twice as high as in the general population. Furthermore, the authors wrote that prenatal exposure to plastic additives like phthalates and bisphenols leads to worse social and physical outcomes in children (FPF reported, also here and here). To conclude their summary on health effects they write that, "[p]lastic causes disease, disability, and premature death at every stage of its long and complex life cycle – from extraction of the coal, oil, and gas that are its main feedstocks, to transport, manufacture, refining, use, recycling, combustion, and through to reuse, recycling and disposal into the environment."

Read More

Food Packaging Forum, 21-03-23

https://www.foodpackagingforum.org/news/report-outlines-how-plastic-production-harms-human-health-environment-economy

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ECHA seeks input on proposed PFAS restriction

2023-03-22

ECHA/NR/23/08

The European Chemicals Agency invites interested parties to send in scientific and technical information on the manufacture, placing on the market and use of per- and polyfluoroalkyl substances (PFAS) by 25 September 2023.

Helsinki, 22 March 2023 – The six-month consultation on the restriction proposal, prepared by the Danish, German, Dutch, Norwegian and Swedish authorities, opens on 22 March 2023 and closes on 25 September 2023 (23:59 Helsinki time).

The consultation is to give anyone with information on PFAS the opportunity to have their say. Of particular interest is information relevant to the risks, socio-economic aspects, and alternative substances.

ECHA's scientific committees for Risk Assessment (RAC) and for Socio-Economic Analysis (SEAC) will use the consultation input to evaluate the proposed restriction and to form an opinion on it.

The consultation is to give anyone with information on PFAS the opportunity to have their say.

An online information session will be held on 5 April from 11:00 to 13:00 Helsinki time. During the session, experts from ECHA and the five national authorities will explain the restriction process, the content of the proposal and how to participate in the consultation. They will also respond to questions from the participants.

The session will be held in English and can be viewed directly from ECHA's homepage without registration. Questions can be sent to the expert panel in advance of the session through this link.

The five national authorities submitted the universal proposal to restrict PFAS to ECHA on 13 January. The European Commission, together with the EU Member States, will eventually decide on the potential restriction based on the proposal and the committees' opinion.

A separate 60-day consultation of SEAC's draft opinion concerning ECHA's proposal to ban the placing on the market, use and formulation of all PFAS in firefighting foams is open from 15 March until 15 May 2023. Make sure that you submit information concerning firefighting foams in this consultation.

REACH Update

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ECHA, 22-03-23

https://echa.europa.eu/-/echa-seeks-input-on-proposed-pfas-restriction

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Janet's Corner

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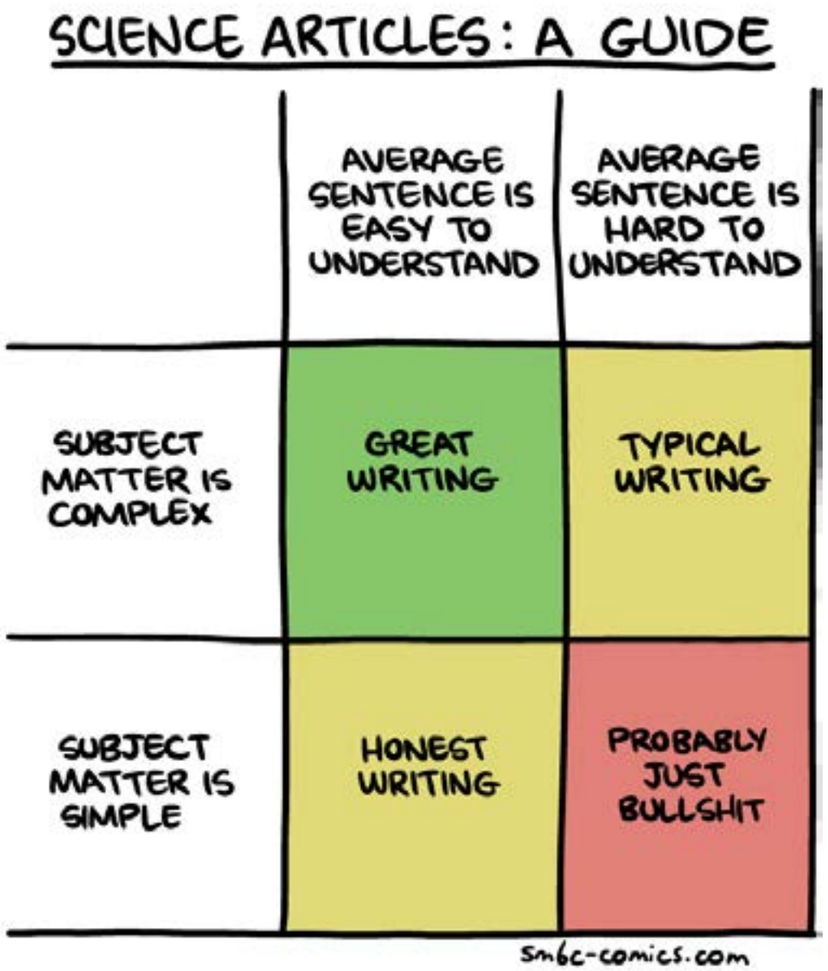
A Guide to Science Writing

2023-03-31



https://www.smbc-comics.com/comic/a-guide-to-science-writing

Perchlorate

2023-03-31

Perchlorates are the salts derived from perchloric acid ($HClO_4$). They are colourless and have no odour and occur both naturally and through manufacturing. Most perchlorate salts are soluble in water. They have been used as a medicine for more than 50 years to treat thyroid gland disorders. [1]

Perchlorates are stable at normal temperatures, but when they are heated to a high temperature, they begin to react. Once they begin to react, they produce a large amount of heat. This causes more of the perchlorates to begin reacting, which makes even more heat. This chain reaction process repeats itself over and over until an explosion occurs. Because perchlorates react this way, they are used in rocket motors, fireworks, flares, gunpowder, and explosives.[2]

USES [3]

The most common use of perchlorate is in ammonium perchlorate, which is a major ingredient of rocket fuels. Perchlorate is also used to make flares, explosives, blasting agents, fireworks, and military munitions such as grenades. It is used to produce other chemicals, including perchloric acid and perchlorate salts. Perchlorate and perchlorate salts are used to make matches, dyes, rubber, lubricating oils, car air bag inflators, road flares, drying and etching agents, gunpowder, batteries, chlorine and chlorine-based cleaners, pool chlorination chemicals, electronic tubes, paint, enamel, fertilisers, and nuclear reactors. They are also used in electroplating, leather tanning and finishing, and aluminium refining. Chewing tobacco may contain perchlorate. Potassium perchlorate is used under limited conditions in thyroid tests for medical patients.

IN THE ENVIRONMENT [2]

Perchlorates are found in the environment in two forms, either as a solid or dissolved in water. If no water is present, as in a drum or on top of dry ground, then they will exist as solids. If water is present, then they will quickly dissolve. When perchlorates dissolve, they separate into two parts. One part has a positive charge, and the other part has a negative charge. The part with the negative charge is called the perchlorate anion or just perchlorate. Perchlorates are soluble in water and generally have high mobility in soils. This characteristic results in their ability to move from soil surfaces into groundwater (a process called leaching) when they enter

Perchlorates are the salts derived from perchloric acid (HClO4). They are colourless and have no odour and occur both naturally and through manufacturing.

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the environment. Perchlorates are ionic substances and therefore, do not volatilise from water or soil surfaces. Perchlorates are known to remain unreacted in the environment for long periods of time; however, there is evidence that microorganisms found in soil and water may eventually reduce perchlorate to other substances. If perchlorates are released to air, then they will eventually settle out of the air, primarily in rainfall. Perchlorates do not appear to accumulate in animals.

SOURCES & ROUTES OF EXPOSURE

Sources of Exposure [4]

- Human exposure to perchlorate is expected to occur through the ingestion of food and milk. The Food and Drug Administration (FDA) recently estimated that the US population ingests from 0.08 to 0.39 µg/kg/day perchlorate from food items.
- Human exposure to perchlorate also can occur through the ingestion of water, as it has been found in drinking water supplies, tap water samples, and groundwater at some locations.
- Efforts are being made to determine the relative contribution of perchlorate from food and water.
- Sources of perchlorates include rocket fuel, flares, gunpowder, temporary adhesives, electrolysis baths, batteries, drying agents, etching agents, oxygen generating systems, matches, chlorine and chlorine based cleaners, and pool chlorination chemicals.
- Chewing tobacco could be a source of exposure because perchlorate has been detected in several brands of chewing tobacco.
- Occupational exposure to perchlorates may occur through the inhalation of dusts formed during their manufacture and use.
- Deposition of perchlorate dust into the mouth is also possible.

Routes of Exposure [4]

The major routes of exposure to perchlorates include:

- Ingestion (drinking contaminated water, eating contaminated food including milk).
- Inhalation (breathing dusts or suspended particles).
- Dermal (contact with contaminated soil).

HEALTH EFFECTS [5]

The health effects of perchlorate salts are due to the perchlorate itself and not to the other component (i.e., magnesium, ammonium, potassium, etc.). Perchlorate affects the ability of the thyroid gland to take up iodine. Iodine is needed to make hormones that regulate many body functions after they are released into the blood. Perchlorate's inhibition of iodine uptake must be great enough to affect the thyroid before it is considered harmful. Healthy volunteers who took about 35 milligrams (35 mg) of perchlorate every day for 14 days or 3 mg for 6 months showed no signs of abnormal functioning of their thyroid gland or any other health problem. Studies of workers exposed for years to approximately the same amount of perchlorates found no evidence of alterations in the worker's thyroids, livers, kidneys, or blood. However, there is concern that people exposed to higher amounts of perchlorate for a long time may develop a low level of thyroid activity; the name of this medical condition is hypothyroidism. Low levels of thyroid hormones in the blood may lead to adverse effects on the skin, cardiovascular system, pulmonary system, kidneys, gastrointestinal tract, liver, blood, neuromuscular system, nervous system, skeleton, male and female reproductive system, and numerous endocrine organs.

Studies in animals also have shown that the thyroid gland is the main target of toxicity for perchlorate. Perchlorate did not affect reproduction in a study in rats.

SAFETY [6]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.
- Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

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- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Handling and Storage

- Keep away from heat.
- Keep away from sources of ignition.
- Keep away from combustible material.
- Empty containers pose a fire risk; evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust.
- Take precautionary measures against electrostatic discharges.
- Wear suitable protective clothing.
- In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.
- Avoid contact with skin and eyes.
- Keep away from incompatibles such as reducing agents, combustible materials, organic materials, acids.
- Keep container tightly closed.
- Keep container in a cool, well-ventilated area.
- Separate from acids, alkalies, reducing agents and combustibles.

Exoisure Controls & Personal Protection

Engineering Controls

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

Personal Protective Equipment

The following personal protective equipment is recommended when handling perchlorates:

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

Personal Protection in Case of a Large Spill:

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

REGULATION

United States [4]

EPA: The United States Environmental Protection Agency adopted a Reference Dose (RfD) for perchlorate in 2005, and issued guidance regarding the cleanup of perchlorate at Superfund sites in 2006. EPA is currently evaluating whether there is a meaningful opportunity to reduce health risk through national drinking water regulation for perchlorate.

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Yes, a 100% sustainable plastics industry is possible

2023-03-22

Plastic is everywhere. Our society can't do without it: plastics have numerous advantages, are extremely versatile, and are also cost effective.

Today, plastics are mainly produced from crude oil. When the products reach the end of their life, they often end up in a waste incineration plant. The energy-intensive production of plastics and their incineration release large amounts of CO2 into the atmosphere, making plastic products a major contributor to climate change.

One way out would be to rely on sustainable production methods, such as the circular economy, in which as much plastic as possible is recycled. Then the main raw material for plastic products would no longer be crude oil but shredded plastic waste.

But is it even possible to tweak the plastics economy to absolute sustainability? The researchers say, yes, it is.

Beyond energy and climate issues

The researchers looked at the complete value chains of the 14 most common types of plastics, including polyethylene, polypropylene, and polyvinyl chloride. These 14 bulk plastics account for 90% of the plastic products manufactured worldwide.

As reported in Nature Sustainability, the researchers investigated for the first time whether it is possible for the plastics industry to respect planetary boundaries. These are a measure of comprehensive sustainability that goes beyond energy and climate issues to include, for example, impacts on land and water sources, ecosystems, and biodiversity. In short: processes that adhere to planetary boundaries can be sustained over the long term without depleting the Earth's resources.

The study finds that circular plastics are feasible within planetary boundaries. This would require at least 74% of the plastic to be recycled. By way of comparison, only around 15% is recycled in Europe today, and the rate is likely to be much lower in other regions of the world.

In addition, the study finds that recycling processes would have to be improved. Specifically, plastics recycling would have to become as efficient as other chemical processes already are today. As things currently stand, not all plastics can be recycled. In the case of polyurethanes used as foams, for example, recycling has yet to be established.

Lots of recycling, combined with the use of CO2 from the air and biomass, could make a completely sustainable plastics industry a reality, according to a new study.

For the remaining maximum 26% of plastics, the carbon needed for production could be sourced using two other technologies, according to the study: on the one hand, CO2 captured from combustion processes or from the atmosphere (known as carbon capture and utilization or CCU), and on the other hand, from biomass.

"Recycling alone won't do it; we need all three pillars," says lead author André Bardow, professor of energy and process systems engineering at ETH Zurich.

"Increasing the recycling rate to 74% worldwide is a very ambitious goal," Bardow admits. As such, it is unlikely to be achieved by 2030, but 2050 is more realistic. Another challenge, however, is that more plastic products are currently being manufactured year after year. If the current trend continues until 2050, it won't be enough to simply improve recycling processes, as planetary boundaries would still be exceeded in 2050. That is why the study's authors suggest also addressing demand as well as assigning a different value to plastic.

"Plastic is considered cheap, which for a long time was a blessing but has now become a curse," Bardow says. "Given its outstanding properties, we should view plastic as the high-quality material it truly is. That way, it would be okay for it to cost a little more, and its recycling, too."

Plastics industry responsibility

In the study, the researchers point out that plastic products must be better aligned with the circular economy in future. To this end, manufacturers should work more closely with recyclers.

According to the study's authors, it would be desirable if plastics manufacturers had a wider understanding of the responsibility they hold: Today, responsibility often ends where the product leaves the factory gates. The scientists therefore call for product stewardship to encompass the entire life cycle—including disposal and recycling—as the basis for optimizing the design of sustainable processes.

In any case, pushing recycling is the right way to go: given that it has no serious disadvantages, it should be treated as a special case in the transformation of the economy toward sustainability. In many other areas, conflicting goals arise.

Take, for example, the production of synthetic fuels, which is extremely energy-intensive, or the use of biomass, which competes with food

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production. Recycling plastic, on the other hand, does not lead to such a conflict of goals.

"Recycling efforts should be intensified wherever possible," Bardow says. "As a good rule of thumb: More recycling of plastic always leads to more sustainability."

Additional coauthors are from RWTH Aachen University; the University of California, Santa Barbara; and ETH Zurich.

Futurity, 22 March 2023

https://futurity.org

Scientists deliver 'final warning' on climate crisis: act now or it's too late

2023-03-21

Scientists have delivered a "final warning" on the climate crisis, as rising greenhouse gas emissions push the world to the brink of irrevocable damage that only swift and drastic action can avert.

IPCC report says only swift and drastic action can avert irrevocable damage to world

The Intergovernmental Panel on Climate Change (IPCC), made up of the world's leading climate scientists, set out the final part of its mammoth sixth assessment report on Monday.

The comprehensive review of human knowledge of the climate crisis took hundreds of scientists eight years to compile and runs to thousands of pages, but boiled down to one message: act now, or it will be too late.

The UN secretary general, António Guterres, said: "This report is a clarion call to massively fast-track climate efforts by every country and every sector and on every timeframe. Our world needs climate action on all fronts: everything, everywhere, all at once."

In sober language, the IPCC set out the devastation that has already been inflicted on swathes of the world. Extreme weather caused by climate breakdown has led to increased deaths from intensifying heatwaves in all regions, millions of lives and homes destroyed in droughts and floods, millions of people facing hunger, and "increasingly irreversible losses" in vital ecosystems.

Monday's final instalment, called the synthesis report, is almost certain to be the last such assessment while the world still has a chance of limiting

global temperature rises to 1.5C above pre-industrial levels, the threshold beyond which our damage to the climate will rapidly become irreversible.

Kaisa Kosonen, a climate expert at Greenpeace International, said: "This report is definitely a final warning on 1.5C. If governments just stay on their current policies, the remaining carbon budget will be used up before the next IPCC report [due in 2030]."

More than 3bn people already live in areas that are "highly vulnerable" to climate breakdown, the IPCC found, and half of the global population now experiences severe water scarcity for at least part of the year. In many areas, the report warned, we are already reaching the limit to which we can adapt to such severe changes, and weather extremes are "increasingly driving displacement" of people in Africa, Asia, North, Central and South America, and the south Pacific.

All of those impacts are set to increase rapidly, as we have failed to reverse the 200-year trend of rising greenhouse gas emissions, despite more than 30 years of warnings from the IPCC, which published its first report in 1990.

The world heats up in response to the accumulation of carbon dioxide and other greenhouse gases in the atmosphere, so every year in which emissions continue to rise eats up the available "carbon budget" and means much more drastic cuts will be needed in future years.

Yet there is still hope of staying within 1.5C, according to the report. Hoesung Lee, the chair of the IPCC, said: "This synthesis report underscores the urgency of taking more ambitious action and shows that, if we act now, we can still secure a livable sustainable future for all."

Temperatures are now about 1.1C above pre-industrial levels, the IPCC found. If greenhouse gas emissions can be made to peak as soon as possible, and are reduced rapidly in the following years, it may still be possible to avoid the worst ravages that would follow a 1.5C rise.

Richard Allan, a professor of climate science at the University of Reading, said: "Every bit of warming avoided due to the collective actions pulled from our growing, increasingly effective toolkit of options is less worse news for societies and the ecosystems on which we all depend."

Guterres called on governments to take drastic action to reduce emissions by investing in renewable energy and low-carbon technology. He said rich countries must try to reach net zero greenhouse gas emissions "as close

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as possible to 2040", rather than waiting for the 2050 deadline most have signed up to.

He said: "The climate timebomb is ticking. But today's report is a how-to guide to defuse the climate timebomb. It is a survival guide for humanity. As it shows, the 1.5C limit is achievable."

John Kerry, the US special presidential envoy for climate, said: "Today's message from the IPCC is abundantly clear: we are making progress, but not enough. We have the tools to stave off and reduce the risks of the worst impacts of the climate crisis, but we must take advantage of this moment to act now."

Monday's "synthesis report" is the final part of the sixth assessment report (AR6) by the IPCC, which was set up in 1988 to investigate the climate and provide scientific underpinning to international policy on the crisis. The first three sections of AR6, published between August 2021 and April 2022, covered the physical science behind the climate crisis, and warned irreversible changes were now almost inevitable; section two covered the impacts, such as the loss of agriculture, rising sea levels, and the devastation of the natural world; and the third covered the means by which we can cut greenhouse gases, including renewable energy, restoring nature and technologies that capture and store carbon dioxide.

The "synthesis report" contains no new science, but draws together key messages from all of the preceding work to form a guide for governments. The next IPCC report is not due to be published before 2030, making this report effectively the scientific gold standard for advice to governments in this crucial decade.

The final section of AR6 was the "summary for policymakers", written by IPCC scientists but scrutinised by representatives of governments around the world, who can – and did – push for changes. The Guardian was told that in the final hours of deliberations at the Swiss resort of Interlaken over the weekend, the large Saudi Arabian delegation, of at least 10 representatives, pushed at several points for the weakening of messages on fossil fuels, and the insertion of references to carbon capture and storage, touted by some as a remedy for fossil fuel use but not yet proven to work at scale.

In response to the report, Peter Thorne, the director of the Icarus climate research centre at Maynooth University in Ireland, said next year global temperatures could breach the 1.5C limit, though this did not mean the limit had been breached for the long term. "We will, almost regardless

of the emissions scenario given, reach 1.5C in the first half of the next decade," he said. "The real question is whether our collective choices mean we stabilise around 1.5C or crash through 1.5C, reach 2C and keep going."

The Guardian, 21 March 2023

https://theguardian.com

"Very High" Accuracy – Machine Learning Helps Separate Compostable From Conventional Plastic Waste

2023-03-22

The use of compostable plastics is increasing, and while they offer several benefits, these materials, such as wrappers and packaging, can mix with and contaminate traditional plastic waste during recycling. To address this issue, scientists have employed advanced imaging techniques and created machine-learning algorithms capable of distinguishing compostable plastics from conventional ones.

Disposable plastics are everywhere in our lives, appearing in various forms such as food containers, coffee cups, and plastic bags. Although certain plastics are designed to biodegrade under controlled conditions, they are still problematic as they often resemble traditional plastics. When these compostable plastics are recycled improperly, they can contaminate plastic waste streams, leading to a reduction in recycling efficiency. Furthermore, recyclable plastics are often mistaken for compostable ones, resulting in polluted compost.

Researchers at University College London (UCL) have published a paper in Frontiers in Sustainability in which they used machine learning to automatically sort different types of compostable and biodegradable plastics and differentiate them from conventional plastics.

"The accuracy is very high and allows the technique to be feasibly used in industrial recycling and composting facilities in the future," said Prof Mark Miodownik, corresponding author of the study.

Up to perfect accuracy

The researchers worked with different types of plastics measuring between 50mm by 50mm and 5mm by 5mm. Conventional plastic samples included PP and PET, often used for food containers and drinking bottles, as well as LDPE, used, among other things, for plastic bags and packaging. Compostable plastic samples included PLA and PBAT, used for cup lids, tea bags, and magazine wraps; as well as palm-leaf and

Researchers have created classification models that enable accurate and automated sorting of various types of plastics.

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sugarcane, both biomass-derived materials used to produce packaging. The samples were divided into a training set, used to build classification models, and a testing set, used to check accuracy.

Results showed high success rates: The model achieved perfect accuracy for all materials when the samples measured more than 10mm by 10mm. For sugarcane-derived or palm-leaf-based materials measuring 10mm by 10mm or less, however, the misclassification rate was 20% and 40%, respectively.

Looking at pieces measuring 5mm by 5mm, some materials were identified more reliably than others: For LDPE and PBAT pieces the misclassification rate was 20%; and both biomass-derived materials were misidentified at rates of 60% (sugarcane) and 80% (palm-leaf). The model was, however, able to identify PLA, PP, and PET pieces without error, regardless of sample measurements.

Beyond the visible

"Currently, most compostable plastics are treated as a contaminant in the recycling of conventional plastics, reducing their value. Trommel and density sorting are applied to screen compost and reduce the presence of other materials. However, the level of contaminants from the current screening process is unacceptably high," explained Miodownik. "The advantages of compostable packaging are only realized when they are industrially composted and do not enter the environment or pollute other waste streams or the soil."

To improve accuracy, a team of scientists including Nutcha Teneepanichskul, Prof Helen Hailes, and Miodownik from UCL's Plastic Waste Innovation Hub tested different types of conventional, compostable, and biodegradable plastics, using hyperspectral imaging (HSI) for classification model development. HSI is an imaging technique that detects the invisible chemical signature of different materials while scanning them, producing a pixel-by-pixel chemical description of a sample. AI models were used to interpret these descriptions and make a material identification.

Plastic mismanagement in recycling and industrial composting processes is high, making reliable sorting mechanisms essential. "Currently, the speed of identification is too low for implementation at an industrial scale," Miodownik pointed out. However, "we can and will improve it since

automatic sorting is a key technology to make compostable plastics a sustainable alternative to recycling."

Sci Tech Daily, 22 March 2023

https://scitechdaily.com

Human stem cells used to create new type of biohybrid neural implant

2023-03-22

Researchers at the University of Cambridge have developed a new type of neural implant that combines stem cells with electronics and has the potential to help amputees or those who've lost the use of their limbs.

Developments in implantable neurotechnology and cell therapy offer potentially effective treatments for those with injuries to the peripheral nervous system, that is, the nerves that lie outside the brain and spinal cord. Both try to restore function to paralyzed or amputated limbs by either bypassing the site of injury to interact with existing nerve cells or by replacing damaged cells with new ones.

However, there are drawbacks. Insofar as the replacement of damaged cells is concerned, transplanted neurons can struggle to establish functional connections. And electrodes can't work effectively without healthy working cells to interface with, commonly due to scar tissue that has built up at an injury site. Moreover, current neurotechnologies lack the ability to interface with different types of neurons responsible for performing different functions.

A potential answer to these issues lies in a biohybrid device, one which combines human stem cells with bioelectronics to create a more effective neural interface. Now, researchers at the University of Cambridge have done just that, creating a groundbreaking new biohybrid device that can integrate with body tissues.

The device's key ingredient is induced pluripotent stem cells (iPSCs), adult cells – usually skin or blood cells – that have been reprogrammed in a lab to become like embryonic stem cells, which can develop into any other type of cell. The researchers used iPSCs to create myocytes, the cells that are the building blocks of skeletal muscles. It's the first time iPSCs have been used in a living organism in this way.

The iPSCs were arranged in a grid on microelectrode arrays (MEAs) so thin that they can attach to the end of a nerve. This generated a layer of

Developments in implantable neurotechnology and cell therapy offer potentially effective treatments for those with injuries to the peripheral nervous system.

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myocytes that sat between the device's electrodes and the living tissue. The researchers then implanted the biohybrid device into rats for testing. They attached the cell-covered side of the device to the severed ulnar and median nerves in the rats' front legs. These nerves were chosen because they approximate injuries to human upper limb nerves and the associated loss of fine motor and sensory functions.

Compared with the control group, researchers found that the device integrated with the rat's body and prevented the formation of scar tissue. Further, the iPSC-derived cells survived for four weeks following implantation, the first time that cells have survived an extended experiment of this kind.

"These cells give us an enormous degree of control," said Dr Damiano Barone, co-author of the study. "We can tell them how to behave and check on them throughout the experiment. By putting cells in between the electronics and the living body, the body doesn't see the electrodes, it just sees the cells, so scar tissue isn't generated."

After four weeks, researchers tested the implanted nerves and found that they behaved like normal nerves, indicating healthy neural physiology. While the rats did not regain movement to the paralyzed limb, the device could detect signals sent by the brain that control movement.

The new device could assist amputees, where the challenge is trying to regenerate neurons and rebuild damage to the nerve circuitry caused by injury or amputation.

"If someone has an arm or a leg amputated, for example, all the signals in the nervous system are still there, even though the physical limb is gone," Barone said. "The challenge with integrating artificial limbs, or restoring function to arms or legs, is extracting the information from the nerve and getting it to the limb so that function is restored."

The researchers say their device could overcome this problem by interacting directly with the neurons that control motor function.

"This interface could revolutionize the way we interact with technology," said co-first author Amy Rochford. "By combining living human cells with bioelectronic materials, we've created a system that can communicate with the brain in a more natural and intuitive way."

The device has advantages over standard, non-stem-cell neural implants. Its small size means it's implantable using keyhole surgery, and the use of lab-produced stem cells makes it highly scalable.

"This technology represents an exciting new approach to neural implants, which we hope will unlock new treatments for patients in need," said Dr Alejandro Carnicer-Lombarte, co-first author of the study.

The device will require further research and extensive testing before being used on humans, but it represents a promising development in neural implants. The researchers are working on optimizing the device and improving its scalability.

The study was published in the journal Science Advances.

New Atlas, 22 March 2023

https://newatlas.com

Drinking straws reveal new laws for the flow of fluids

2023-03-23

Researchers have uncovered new laws governing the flow of fluids through experiments on a technology that's thousands of years old: a drinking straw.

What they learned could be useful for improving fluid handling in medical and engineering applications.

"We found that sipping through a straw defies all the previously known laws for the resistance or friction of flow through a pipe or tube," says Leif Ristroph, an associate professor at New York University's Courant Institute of Mathematical Sciences and an author of the study in the Journal of Fluid Mechanics.

"This motivated us to search for a new law that could work for any type of fluid moving at any rate through a pipe of any size."

Pipe-flow problem

Flows of liquids and gasses through pipes, tubes, and ducts occur in many situations in nature and industry—such as with blood flow and in oil pipelines.

"The pipe-flow problem has always been one of the most basic and important in the study of fluid mechanics, and in many ways the field was developed to address this problem," says Ristroph, director of NYU's Applied Mathematics Laboratory, where the research was conducted.

"We found that sipping through a straw defies all the previously known laws for the resistance or friction of flow through a pipe or tube."

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However, in their work, Ristroph and his colleagues found that all known laws relating pressure and flow rate were accurate only under certain conditions.

To reach this conclusion, they conducted a series of experiments—measurements of flow rate and pressure for metallic pipes of different lengths and diameters using several types of liquid.

The goal was to determine how these factors relate to the frictional resistance of the flow going through the pipe.

"Our data showed that the famous and classical laws for flow friction are only accurate for some combinations of flow speeds and pipe sizes," explains Ristroph. "We mapped out the conditions when the existing laws don't work well, and we found a good example right under our noses: drinking through a straw."

Flow of fluids through varied straws

Drinking straws are thought to have been used as far back as 5,500 years ago in the early Mesopotamian civilization of Sumeria. But the hydrodynamics of their operation was not previously studied.

The researchers expanded their study to include several kinds of straws—a thin coffee stirrer type, a regular soda type, and a wide bubble tea type—and they performed experiments to determine the friction for flow rates that are typical during drinking.

The data on straws and similarly sized pipes did not match any of the known laws, which are named for their discoverers, the scientists Evangelista Torricelli and Jean Léonard Marie Poiseuille, among others.

The researchers found that each classical law failed because it assumes that the pipe is either very short or very long, and that the flow is either very slow or very fast.

The in-between cases, including straws, involve complicated factors such as how the flow changes along the length of the pipe and whether it becomes smooth and laminar or rough and turbulent.

Modeling such effects allowed the team to derive a single mathematical formula, and its predictions matched the experimental measurements for all pipes and straws and for all fluids and flow speeds that were tested.

"A universal formula could be very useful, for example, in understanding and modeling blood flow in the circulatory system," Ristroph observes.

"Our veins, arteries, and capillaries are basically pipes with many different diameters, lengths, and flow rates."

The National Science Foundation supported the work.

Futurity, 23 March 2023

https://futurity.org

Some 'recycled' product claims are mostly garbage

2023-03-23

To jumpstart a paltry market for recycled plastic, governments across the globe are pushing companies to include recycled materials in their products. Last year, the United Kingdom introduced a tax on manufacturers that produce or import plastic packaging containing less than 30 percent recycled plastic. In 2024, New Jersey will begin enforcing similar rules, albeit with lower targets. California now requires that beverage containers be made of 15 percent recycled materials, and Washington will enact a similar requirement later this year. The European Commission, Canada, and Mexico are all considering comparable moves.

Currently, most plastic products are derived from freshly extracted fossil fuels, including crude oil and natural gas. Incorporating some recycled plastic could reduce emissions, and shrink pollution in waterways and landfills, experts say. But collecting, sorting, pulverizing, and melting post-consumer plastics for reuse is expensive. The new laws will potentially help recyclers find buyers for what would otherwise become waste.

But regulators may need a better way to verify that the new laws are working. While companies can enlist a third-party to certify their use of recycled content, most certifiers take a bird's-eye view, tracking the materials across a range of products and factories. As a result, an item with a "recycled content" label might be completely devoid of recycled content.

This current approach, called mass balance, poses additional challenges for those seeking to verify recycled content. To work well, mass balance requires trustworthy and accurate data, which are not always available across a convoluted supply chain. Experts warn mass balance may also lead to inflated estimates of recycled content.

Researchers in the U.K. have developed a novel method to measure this recycled content that adds fluorescent dyes to recycled plastics at the beginning of manufacturing. By measuring the change in color, the team can determine the amount of recycled content in each individual plastic product. Through the nonprofit ReCon2, the team is running pilot tests in real-world conditions and says this approach can help prevent fraud, keep costs low, and improve consumer trust.

Recent laws encourage recycling old plastic into new products. But verifying recycled content relies on tricky math.

In 2019, the world generated roughly 350 million tons of plastic, a doubling of production over the past two decades. Just 6 percent of global plastics produced came from recycled plastics, leaving most to be shoveled into landfills, incinerated, or carried into ecosystems. Recycling is not sufficient for solving the problem of plastic pollution, many researchers suggest. Instead, the issue will require some measure of reduction and re-use as well. Nevertheless, scientists say that these new laws and technologies that focus on this last option could mitigate the environmental harms of plastic production.

It's "imperative" to be able to track materials through this recycling market in a way that makes sense, said Katrina Knauer, a researcher at the National Renewable Energy Laboratory. "If we really want to make the circular economy a reality, efficient tracking and quantifiable tracking is going to be the only way we can really do that and create trust in a system."

Companies like Unilever, Coca-Cola, and PepsiCo have been making claims about using recycled content in their products for years. But the term "recycled content" is as flexible as the term "organic" before regulators clamped down on its use, said Knauer. Earning that badge now requires ticking several boxes determined by federal agencies in the U.S. and the European Commission in the EU. Recycled content hasn't received the same kind of regulatory scrutiny.

As the recycling industry develops, "I think we will run into some of the same challenges that we ran into in the past with companies making claims that may not be very true," said Knauer, who is also the chief technology officer at the Bio-Optimized Technologies to keep Thermoplastics out of Landfills and the Environment, an organization at the Department of Energy that helps companies adopt greener plastics technologies.

Right now, many companies use mass balance, which considers all of the inputs that go into making a product and then balances them with the outputs to calculate the amount of recycled material.

For example, say there are 20 plastic bottles in a recycling bin. Those enter a mass balance when they are handed over to a recycling company. A manufacturer may then buy these bottles from the recycling company, as well as the equivalent of 80 bottles from newly extracted oil or gas.

Assuming the manufacturer then produces 100 total bottles, the mass balance will conclude that each bottle is made with 20 percent recycled content.

But there's a twist: Under some certification schemes, the company can attribute its recycled material evenly across several plants, including those that haven't been able to acquire any recycled material. As a result, you usually cannot calculate a single product's recycled content, if it has any at all.

For Zero Waste Europe, a network of European communities and experts pushing companies and governments to reduce waste, this makes the mass balance approach "a simplistic and meaningless bookkeeping exercise." But the problem goes beyond misleading marketing. Recycled material can be lower quality, and too much in a product may threaten the product's integrity.

There are some benefits to mass balance's flexible approach. With the supply of recycled plastics limited in some areas, it's helpful to allow companies to compensate by using extra recycled content in areas with plenty to buy.

Eventually, however, consumers should be able to expect that the bottle in their hands has a specific level of recycled content. "That's the ultimate goal, but it is a really complex system, and it takes a long time to make changes, so we'll probably need to rely on mass balance to meet that kind of transition," said Alix Grabowski, director of plastic and material science at the World Wildlife Fund.

That system complexity is felt in other ways, too. Tracking recycled materials along sometimes tortuous chains of purchases depends on trust between companies, said Wan-Ting Hsu, a material flow research analyst and Ph.D. candidate at University College London. Post-consumer plastic material can pass between many companies and jurisdictions with different rules about responsibility and accounting before it returns to retailers ready to sell it back to consumers.

In interviews with key stakeholders in the plastics value chain, such as brand owners and recyclers, Hsu has learned that companies struggle to verify the source of material, and often they are left to ask for data from previous owners, which can sometimes be inaccurate. Without better proof of content, companies could make misleading claims, experts say, though they could not point to public evidence of such cases.

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Another issue: The methods to certify recycled content vary across certification bodies, and there is little consistency. When the Canadian government commissioned the environmental consultancy company Eunomia to consult with manufacturers, as evidenced in the 2021 report, the manufacturers said they often chose certification schemes that offered the most flexible approach. Under such schemes, the company with 20 recycled bottles in its mix of 100, for example, could claim 20 of its bottles are 100 percent recycled, even when this is not the case.

"At this point we haven't had any real legislation for this," said Sarah Edwards, North America CEO at Eunomia. Up until now, she added, companies have used certification more for marketing or as part of longer-term sustainability goals.

The California Department of Resources Recycling and Recovery told Undark that it requires beverage manufacturers to report data to them directly and does not use third-party certifiers at this time. It would not disclose the method to certify information reported. In a draft rule in Washington state that will be finalized later this year, the Department of Ecology said it will require that producers attest to the accuracy of their data or obtain third-party certification.

Mass balance is especially contentious when it is used to certify products created from chemical recycling, a collection of mostly new techniques to strip plastics down to their basic building blocks, called monomers. In contrast to mechanical recycling, which shreds plastic but keeps its chemical form, manufacturers can use monomers to construct many different kinds of plastics, which are made up of polymers.

As part of the chemical recycling process, a plant may burn a portion of the recycled material into fuel or other byproducts. Though this process releases greenhouse gases, some mass balance certifications allow a company to count the burned plastic towards its output of "recycled content." The hypothetical supply chain that takes in 20 recycled bottles may still claim to produce bottles with 20 percent recycled content, even if 5 of those recycled bottles have been burnt as fuel.

In its 2021 report, Eunomia wrote that the chemical sector preferred to work with ISCC Plus, a third-party certifier in Germany that allows this kind of tabulation. In Edwards' eyes, the chemical recycling industry is pushing for this as a temporary tool to get started.

Post-consumer plastic material can pass between many companies and jurisdictions with different rules about responsibility and accounting before it returns to retailers ready to sell it back to consumers.

There's an additional point of contention: With some processes of reducing polymers down to monomers, molecules can react with ambient elements like nitrogen and hydrogen, inflating their weight with molecules that aren't plastic. Calculating a mass balance just on weight — the typical approach for mechanical recycling — doesn't work as well for chemical recycling and can overestimate the recycled content in materials.

A widely cited white paper published by the Ellen MacArthur Foundation, a charity committed to creating a circular economy, provided an example: Producing 100 pounds of polyamide, often used in textiles, would require 150 pounds of recycled material if measured with weight, or 170 pounds if measured with calorific value — a unit that quantifies an object's energy and doesn't change as readily.

Scientists and engineers have agreed to use more precise units, like calorific value, but "there is quite a bit of argument across the industry" about which units to use, Knauer said.

Michael Shaver, a professor of polymer science at the University of Manchester and one of the researchers involved with ReCon2, said the group had "significant concerns in terms of the mass balance approach."

Shaver wanted to develop a way to measure the recycled content in each individual product. He joined with Ph.D. student Zoé Schyns and research fellow Thomas Bennett, and together they developed a technique that adds fluorescent dye to the recycled materials during the manufacturing process. Regardless of what happens between the beginning and end of manufacturing, the ratio between fluorescence at the beginning and end reveals the concentration of recycled content in each individual product. Some of the light appears as green within the visible light spectrum, but one strategy is to keep the precise technique a secret so companies do not misuse it.

"We can show not only that everyone in your supply chain acted appropriately, but also that you have the same in all of your different bottles or film," said Shaver. Although the public results focus on three of the most popular plastic types, the researchers say the approach can be adapted for other kinds of plastics and rules. Sponsors of a year-long trial phase include Kraft-Heinz and Reckitt, two large consumer good corporations, and the U.K.'s leading recycling label, OPRL.

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"If the public believes that this is a measure of exactly how much plastic is in each package, that's not what mass balance actually gives you, right?" Shaver said.

The company believes roll out of the technology would require an industry-wide approach, even as others doubt that plastic producers can adapt to including tracers. Shaver expects that their nonprofit ReCon2 will "shepherd" firms into the program, while it audits participating companies and gatekeeps against products with inaccurate or false recycled content claims. As a nonprofit, it would prioritize keeping the technique as low-cost as possible to promote adoption and minimize fraud through passive compliance.

On a broader scale, Knauer expects that establishing trust in measuring recycled content will take action from governments, as happened with "organic" labels. The U.S. Environmental Protection Agency may be moving in this direction. In 2021, the agency laid out a national recycling strategy that includes the creation of "recycled content measures." (A spokesperson told Undark that the EPA hasn't started working on this yet.)

"I do not think that mass balance is the way we're going to do it forever," said Knauer. "I think there's a lot to be done in this space and a lot more innovation we can certainly do."

Popular Science, 23 March 2023

https://popsci.com

Iridescent, plant-based coatings that cool buildings – and the Earth

2023-03-26

Chemists have made an iridescent, plant-based film that gets cooler in sunlight.

The material, which comes in a range of shining colours, could one day coat buildings and cars, lowering the need for air conditioning.

The film exhibits a smart property: called passive daytime radiative cooling, or PDRC, it doesn't absorb much light, and it radiates heat out at a wavelength that escapes the atmosphere and zooms straight into space.

"To make materials that remain cooler than the air around them during the day, you need something that reflects a lot of solar light and doesn't absorb it, which would transform energy from the light into heat," explains

Researchers create a colourful solution to urban heat.

principal investigator Professor Silvia Vignolini, a chemist at the University of Cambridge, UK.

"There are only a few materials that have this property, and adding colour pigments would typically undo their cooling effects."

Colour usually comes from a pigment that absorbs some sunlight: a green leaf absorbs red and blue light, for instance, leaving green to be reflected out.

This means that if you want something to reflect all sunlight back as light, it usually has to be white.

But colour can come from other properties: structural colour happens when light interacts with tiny structures inside a substance, which bounce the light around until it comes out in a different hue.

Structural colour often produces shining and iridescent results, like in beetles and hummingbirds.

Viglioni and colleagues figured out a way to create the effect with cellulose, which is one of the few naturally occurring materials known to be capable of forming PDRC materials.

Their film, which they're discussing at the spring meeting of the American Chemical Society, is made from cellulose nanocrystals (CNC) – tiny particles about the same size as individual wavelengths of light.

These CNC films can be manipulated to look red, green, or blue, but they're quite brittle. The researchers have figured out how to attach the films to ethyl cellulose: a more flexible white material.

When combined, the researchers had a flexible, colourful film that is 4°C cooler than the ambient temperature during the day.

They've also figured out how to make the films glittery, and show different textures, so they could be adapted to any architectural style.

The films should be easy to manufacture metres at a time, and cellulose is a cheap feedstock.

But before you can coat your car or house with them, the researchers want to see if they can introduce more functions: CNCs can be sensitive

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to pollutants, so they're exploring whether they can build smoke or smog detectors into their films.

Cosmos, 26 March 2023

https://cosmosmagazine.com

Major Breakthrough for "Futuristic" Light-Activated Cancer Treatment

2023-03-23

Scientists at the University of East Anglia (UEA) are a step closer to creating a new generation of light-activated cancer treatments.

The futuristic-sounding treatment would work by switching on LED lights embedded close to a tumor, which would then activate biotherapeutic drugs.

These new treatments would be highly targeted and more effective than current state-of-the-art cancer immunotherapies.

New research published today reveals the science behind this innovative idea.

It shows how the UEA team has engineered antibody fragments — which not only 'fuse' with their target but are also light activated.

It means that in the future, immunotherapy treatments could be engineered to attack tumors more precisely than ever before.

The principal scientist for this study, Dr. Amit Sachdeva, from UEA's School of Chemistry, said: "Current cancer treatments like chemotherapy kill cancer cells, but they can also damage healthy cells in your body such as blood and skin cells.

"This means that they can cause side effects including hair loss, feeling tired and sick, and they also put patients at increased risk of picking up infections.

"There has therefore been a very big drive to create new treatments that are more targeted and don't have these unwanted side-effects.

"Several antibodies and antibody fragments have already been developed to treat cancer. These antibodies are much more selective than the cytotoxic drugs used in chemotherapy, but they can still cause severe side effects, as antibody targets are also present on healthy cells."

By embedding LED lights near a tumor and activating bio-therapeutic drugs, these treatments would be more targeted and effective than current cancer immunotherapies.

Now, the UEA team has engineered one of the first antibody fragments that binds to, and forms a covalent bond with, its target — upon irradiation with UV light of a specific wavelength.

Dr. Sachdeva said: "A covalent bond is a bit like melting two pieces of plastic and fusing them together. It means that drug molecules could for example be permanently fixed to a tumor.

"We hope that our work will lead to the development of a new class of highly targeted light-responsive biotherapeutics. This would mean that antibodies could be activated at the site of a tumor and covalently stick to their target upon light activation.

"In other words, you could activate antibodies to attack tumor cells by shining light – either directly onto the skin, in the case of skin cancer, or using small LED lights that could be implanted at the site of a tumor inside the body.

"This would allow cancer treatment to be more efficient and targeted because it means that only molecules in the vicinity of the tumor would be activated, and it wouldn't affect other cells.

"This would potentially reduce side effects for patients, and also improve antibody residence time in the body."

"It would work for cancers like skin cancer, or where there is a solid tumor – but not for blood cancers like leukemia.

"Development of these antibody fragments would not have been possible without pioneering work from several other research groups across the globe who developed and optimized methods for site-specific incorporation of non-natural amino acids into proteins expressed in live cells.

"We employed some of these methods to site-specifically install unique light-sensitive amino acids into antibody fragments."

If the researchers are successful in the next stages of their work, they hope to see the 'next generation' light-activated immunotherapies being used to treat cancer patients within five to 10 years.

Sci Tech Daily, 23 March 2023

https://scitechdaily.com

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For the first time, astronomers have linked a mysterious fast radio burst with gravitational waves

2023-03-28

We have just published evidence in Nature Astronomy for what might be producing mysterious bursts of radio waves coming from distant galaxies, known as fast radio bursts or FRBs.

Two colliding neutron stars – each the super-dense core of an exploded star – produced a burst of gravitational waves when they merged into a "supramassive" neutron star. We found that two and a half hours later they produced an FRB when the neutron star collapsed into a black hole.

Or so we think. The key piece of evidence that would confirm or refute our theory – an optical or gamma-ray flash coming from the direction of the fast radio burst – vanished almost four years ago. In a few months, we might get another chance to find out if we are correct.

Two colliding neutron stars – each the super-dense core of an exploded star – produced a burst of gravitational waves when they merged into a "supramassive" neutron star.

Brief and powerful

FRBs are incredibly powerful pulses of radio waves from space lasting about a thousandth of a second. Using data from a radio telescope in Australia, the Australian Square Kilometre Array Pathfinder (ASKAP), astronomers have found that most FRBs come from galaxies so distant, light takes billions of years to reach us. But what produces these radio wave bursts has been puzzling astronomers since an initial detection in 2007.

The best clue comes from an object in our galaxy known as SGR 1935+2154. It's a magnetar, which is a neutron star with magnetic fields about a trillion times stronger than a fridge magnet. On April 28 2020, it produced a violent burst of radio waves – similar to an FRB, although less powerful.

Astronomers have long predicted that two neutron stars – a binary – merging to produce a black hole should also produce a burst of radio waves. The two neutron stars will be highly magnetic, and black holes cannot have magnetic fields. The idea is the sudden vanishing of magnetic fields when the neutron stars merge and collapse to a black hole produces a fast radio burst. Changing magnetic fields produce electric fields – it's how most power stations produce electricity. And the huge change in magnetic fields at the time of collapse could produce the intense electromagnetic fields of an FRB.

The search for the smoking gun

To test this idea, Alexandra Moroianu, a masters student at the University of Western Australia, looked for merging neutron stars detected by the Laser Interferometer Gravitational-Wave Observatory (LIGO) in the US. The gravitational waves LIGO searches for are ripples in spacetime, produced by the collisions of two massive objects, such as neutron stars.

LIGO has found two binary neutron star mergers. Crucially, the second, known as GW190425, occurred when a new FRB-hunting telescope called CHIME was also operational. However, being new, it took CHIME two years to release its first batch of data. When it did so, Moroianu quickly identified a fast radio burst called FRB 20190425A which occurred only two and a half hours after GW190425.

Exciting as this was, there was a problem – only one of LIGO's two detectors was working at the time, making it very uncertain where exactly GW190425 had come from. In fact, there was a 5% chance this could just be a coincidence.

Worse, the Fermi satellite, which could have detected gamma rays from the merger – the "smoking gun" confirming the origin of GW190425 – was blocked by Earth at the time.

Unlikely to be a coincidence

However, the critical clue was that FRBs trace the total amount of gas they have passed through. We know this because high-frequency radio waves travel faster through the gas than low-frequency waves, so the time difference between them tells us the amount of gas.

Because we know the average gas density of the universe, we can relate this gas content to distance, which is known as the Macquart relation. And the distance travelled by FRB 20190425A was a near-perfect match for the distance to GW190425. Bingo!

So have we discovered the source of all FRBs? No. There are not enough merging neutron stars in the Universe to explain the number of FRBs – some must still come from magnetars, like SGR 1935+2154 did.

And even with all the evidence, there's still a one in 200 chance this could all be a giant coincidence. However, LIGO and two other gravitational wave detectors, Virgo and KAGRA, will turn back on in May this year, and be more sensitive than ever, while CHIME and other radio telescopes are ready to immediately detect any FRBs from neutron star mergers.

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In a few months, we may find out if we've made a key breakthrough – or if it was just a flash in the pan.

The Conversation, 28 March 2023

https://theconversation.com

A fish can sense another's fear, a study shows

2023-03-24

Our capacity to care about others may have very, very ancient origins, a new study suggests.

It might have been deep-rooted in prehistoric animals that lived millions of years ago, before fish and mammals like us diverged on the tree of life, according to researchers who published their study Thursday in the journal Science.

"Some of the mechanisms that underlie our ability to experience fear, or fall in and out of love, are clearly very ancient pathways," said Hans Hofmann, an evolutionary neuroscientist at the University of Texas at Austin, who was not involved in the research.

Scientists are usually reluctant to attribute humanlike feelings to animals. But it's generally accepted that many animals have moods, including fish.

The new study shows that fish can detect fear in other fish, and then become afraid too – and that this ability is regulated by oxytocin, the same brain chemical that underlies the capacity for empathy in humans.

The researchers demonstrated this by deleting genes linked to producing and absorbing oxytocin in the brains of zebrafish, a small tropical fish often used for research. Those fish were then essentially antisocial – they failed to detect or change their behavior when other fish were anxious.

But when some of the altered fish received oxytocin injections, their ability to sense and mirror the feelings of other fish was restored — what scientists call "emotional contagion."

"They respond to other individuals being frightened. In that regard, they behave just like us," said University of Calgary neuroscientist Ibukun Akinrinade, a co-author of the study.

The study also showed that zebrafish will pay more attention to fish that have previously been stressed out – a behavior the researchers likened to consoling them.

The new study shows that fish can detect fear in other fish, and then become afraid too.

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Previous research has shown that oxytocin plays a similar role in transmitting fear in mice.

The new research illustrates "the ancestral role" of oxytocin in transmitting emotion, said Rui Oliveira, a behavioral biologist at Portugal's Gulbenkian Institute of Science and a study co-author.

This brain processing "may have already been in place around 450 million years ago, when you and me and these little fish last had a common ancestor," explained Hofmann.

Oxytocin is sometimes thought of as a "love" hormone, but Hofmann said it's actually more like "a thermostat that determines what is socially salient in a particular situation – activating neural circuits that may make you run from danger, or engage in courtship behavior."

That could be fundamental to the survival of many animals, especially those who live in groups, said Stony Brook University ecologist Carl Safina, who was not involved in the study.

"The most basic form of empathy is contagious fear – that's a very valuable thing to have to stay alive, if any member of your group spots a predator or some other danger."

AP News, 24 March 2023

https://apnews.com

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How beetles use their butts to suck water from the air

2023-03-22

Insect pests eat their way through thousands of tons of food around the world every year. Food security in developing nations is particularly affected by animal species like the grain weevil and red flour beetle which have specialized in surviving in extremely dry environments, granaries included, for thousands of years.

For a new study in the Proceedings of the National Academy of Sciences, researchers investigated the molecular and physiological processes underlying how beetles stay hydrated.

Indeed, beetles can open their rectums and take up water from moist air and convert it into fluid, which they can then absorb into their bodies. This novel approach to consuming water has been known for more than a century within scientific circles around the world, but never fully clarified until now.

Beetles can survive their entire lives without drinking any liquid water whatsoever. Instead, they suck water from the air with their rear ends.

"We have shed new light on the molecular mechanisms that allow beetles to absorb water rectally. Insects are particularly sensitive to changes in their water balance. As such, this knowledge can be used to develop more targeted methods to combat beetle species which destroy our food production, without killing other animals or harming humans and nature," says lead author Kenneth Veland Halberg, associate professor in the biology department at the University of Copenhagen.

Essential gene in beetle's bottom

The researchers studied the internal organs of red flour beetles to learn more about their ability to absorb water through the rectum. Red flour beetles are used as so-called model organisms, which means that they are offer tools that make them easy to work with and that their biology is similar to that found in other beetles.

Here, the researchers identified a gene that is expressed 60 times more in the beetle's rectum compared to the rest of the animal, which is higher than any other gene they found. This led them to a unique group of cells known as leptophragmata cells. Upon closer inspection, they could see that these cells play a crucial role when the beetle absorbs water through its rear end.

"Leptophragmata cells are tiny cells situated like windows between the beetle's kidneys and the insect circulatory system, or blood. As the beetle's kidneys encircle its hindgut, the leptophragmata cells function by

pumping salts into the kidneys so that they are able to harvest water from moist air through their rectums and from here into their bodies," Veland Halberg says. "The gene we have discovered is essential to this process, which is new knowledge for us."

Besides being able to suck water out of the air, beetles are also extremely effective at extracting liquid from food. Even dry grain, which may consist of 1-2% water, can contribute to a beetle's fluid balance.

"A beetle can go through an entire life cycle without drinking liquid water. This is because of their modified rectum and closely applied kidneys, which together make a multi-organ system that is highly specialized in extracting water from the food that they eat and from the air around them. In fact, it happens so effectively that the stool samples we have examined were completely dry and without any trace of water," Veland Halberg says.

Better pesticides

Over the past 500 million years, beetles have successfully spread across the planet. Today, one in five animal species on Earth is a beetle. Unfortunately, they are also among the pests that have a devastating impact on our food security. The red flour beetle, grain weevil, confused flour beetle, Colorado potato beetle, and other types of beetles make their way into up to 25% of the global food supply every year.

We use approximately $100 billion in pesticides worldwide every year to keep insects out of our food. However, traditional pesticides harm other living organisms and destroy the environment.

Therefore, according to Veland Halberg, it is important to develop more specific and "eco-friendly" insecticides, which only targets insect pests while leaving more beneficial insects, such as bees, alone. This is where a new and better understanding of beetles' anatomy and physiology could become key.

"Now we understand exactly which genes, cells, and molecules are at play in the beetle when it absorbs water in its rectum. This means that we suddenly have a grip on how to disrupt these very efficient processes by, for example, developing insecticides that target this function and in doing so, kill the beetle," he says.

"There is twenty times as much insect biomass on Earth than that of humans. They play key roles in most food webs have a huge impact on virtually all ecosystems and on human health. So, we need to understand them better."

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Additional coauthors are from the University of Edinburgh and the University of Copenhagen.

Futurity, 22 March 2023

https://futurity.org

'Oumuamua isn't an alien probe, but it might be the freakiest comet we've ever seen

2023-03-23

Since its discovery in 2017, the interstellar object 'Oumuamua has been a point of fascination—and sometimes obsession—for astronomy fans. As the first object we've seen from another solar system, it's naturally drawn a lot of interest, with its strange tube-like shape and surprisingly small size. It even accelerated at one point in its orbit, which happens regularly with comets—but 'Oumuamua didn't have the usual gassy tail, leading some to even propose it may be an alien ship.

A new explanation for the space pancake's eccentric orbit has astronomers buzzing.

A new hypothesis, published on March 22 in the journal Nature, proposes a different explanation for 'Oumuamua's anomalous orbit. Astronomers Jennifer Bergner and Darryl Seligman say the half-mile-long object is just a comet after all, but that its time in interstellar space changed its chemistry. Instead of water causing the extra propulsion, 'Oumuamua released nearly invisible hydrogen.

"It's exciting that we can explain the strange behavior of 'Oumuamua without needing to resort to any exotic physics," says Bergner, an astrochemist at the University of California, Berkeley and lead author on the new paper.

"Hopefully this discovery will put to rest any outlandish ideas about 'Oumuamua being an alien probe," adds University of Washington astrobiologist Kaitlin Rasmussen, author of the upcoming book Life in Seven Numbers: The Drake Equation Revealed.

Comets are chunks of ice and debris left over from the process of planet formation, lurking at the edge of our solar system. On their extremely long and stretched out orbits, they occasionally dive in towards the sun. There, the sun's bright rays vaporize some of the comet's ice and dust to make the fuzzy coma and the sweeping tails we see.

'Oumuamua may have begun its life as a typical comet around another star—rich with water ice—before being thrust out into open space by the chaos of a young solar system. (Our solar system likely spewed out

similar chunks of detritus in its early days.) On its voyage between the stars, Bergner and Seligman propose that 'Oumuamua was bombarded with energetic particles known as cosmic rays. These high-energy particles broke the bonds between hydrogen and oxygen in water molecules, creating molecular hydrogen (H2) trapped in the crystalline structure of the ice.

Once 'Oumuamua swung by the sun, the heat rearranged the crystals of its ice, releasing the molecular hydrogen to propel the interstellar interloper and cause its observed acceleration, almost like a rocket booster. "It's more plausible than the other ideas," says UCLA astronomer David Jewitt, "including those relying on carbon monoxide (which was not detected), nitrogen ice (which is relatively hard to find), and, of course, the spaceship idea."

"I think the authors have a very interesting hypothesis," agrees Caltech planetary scientist Qicheng Zhang, who is not affiliated with the research team. The real significance of this result, though, will come with further observations, he adds.

'Oumuamua was only invisible for a short time when it passed within 15 million miles of Earth in 2017; now on Pluto's fringes, it's far beyond the reach of even our largest telescopes. As an alternative to direct data, Bergner and Seligman suggest studying a similar effect on 'Oumuamua-sized comets from our own solar system. But there's one catch—we haven't spotted any solar system comets that small yet. Astronomers hope the next generation of telescopes, including NASA's recently launched James Webb Space Telescope, will spot the first of those objects.

Casey Lisse, an astronomer at Johns Hopkins Applied Physics Lab, also suggests that a comet's H2 may be observable if it splits apart into two hydrogen atoms under the influence of the sun's ultraviolet rays. The signal on a 'Oumuamua look-alike could be picked up by certain satellites like SOHO, NASA's long-running solar space telescope, "which are known to measure bright comets," he says.

Astronomers also expect to root out many more interstellar objects in the coming years; they recorded the second one, known as comet 2I/Borisov, in 2019. "There's approximately one similar object in the inner solar system at any given time," says Seligman, Cornell astronomer and co-author on the Nature study. "When we get the Rubin Observatory and the NEO [Near-Earth Object] Surveyor going, we'll be discovering way more."

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Astronomers think of these interstellar objects as a window into other solar systems: the closest peek we'll get at the building blocks of other planets. "Any object of interstellar origin is incredibly valuable to us because it's bringing clues about the processes going on beyond our solar system," says Bergner.

Popular Science, 23 March 2023

https://popsci.com

Feel your blood boil when you're near a busy road? A new study explains why

2023-03-23

Ever feel your blood boiling when you're walking along a busy road?

You're not imagining it. According to new research, road noise causes your blood pressure to spike.

Wailing sirens, honking horns, and revving motorbikes lead to an increased risk of hypertension, or high blood pressure.

Noise pollution can lead to increased risk of hypertension, new research has revealed.

Previous research attributed the connection between noisy road traffic and blood pressure to air pollution.

But this study - published in JACC: Advances today - proves that the noise alone can elevate hypertension risk.

"We were a little surprised that the association between road traffic noise and hypertension was robust even after adjustment for air pollution," said Jing Huang, assistant professor in the Department of Occupational and Environmental Health Sciences in the School of Public Health at Peking University in Beijing, China, and lead author of the study.

What is high blood pressure?

High blood pressure - also known as hypertension - is a common condition affecting around a third of adults.

If you have high blood pressure, the blood pushes too hard against the artery walls, meaning the heart has to work harder to pump blood.

Over time, this puts strain on your organs and increases your risk of heart attacks, strokes, and aneurysms.

A sudden blood pressure spike can lead to blurred vision, shortness of breath, nosebleeds, chest pain and dizziness.

Why does noise pollution contribute to hypertension?

Researchers analysed data from more than 240,000 people (aged 40 to 69 years) who started out without hypertension. Over eight years, they followed the health records of these people.

People living near road traffic noise were more likely to develop hypertension - and risk increased in tandem with the noise "dose." This remained true when researchers adjusted for exposure to air pollution.

Noise pollution triggers the release of cortisol - a stress hormone.

People who were exposed to air pollution and noise pollution - a common one-two punch for city dwellers - were most at risk of adverse blood pressure effects.

What can we do about noise pollution?

Individuals can try and avoid noisy areas, taking less busy roads where possible, wearing earplugs, insulating walls and windows, and keepingwindows closed when at home.

But ultimately, the solution has to come from policymakers.

Stricter noise guidelines and enforcements - such as limiting heavy traffic at certain times of day - can help. Reducing traffic by making public transport free and accessible for all is also a key step.

Urban planning plays a key role, with noise barriers and urban greenery soaking up the roar of traffic.

Investing in advanced technology to make vehicles quieter is also key.

Euronews, 23 March 2023

https://euronews.com

Super Glue could make it easier to recycle plastic

2023-03-23

One of the greatest inventions humans ever made was by accident. It was 1942, and the US had just entered World War II after the bombing in Pearl Harbor. As Americans enlisted to fight, companies were scrambling for ways to help with the war effort. At the time, the Eastman Kodak Company in Rochester, New York, came up with the idea of a plastic gun sight that would boost the aim of Allied soldiers. In trying to make the piece, chemist

Most plastics can't be broken down into their raw materials. A classic Super Glue ingredient offers something new.

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Henry Coover discovered the sticky properties of a compound called ethyl cyanoacrylate, which eventually became Super Glue.

Coover abandoned his efforts at converting ethyl cyanoacrylate into a plastic and instead focused on developing the product as an instant adhesive. But the potential is still there. Super Glue has the chemical monomer needed to create plastic—someone just needs to figure out how to keep it from instantly bonding with other surfaces. Now, a study published in the journal Science Advances details a new method for easily converting Super Glue into a plastic that can be recycled repeatedly. And while it might have the potential to replace nonbiodegradable plastics, some polymers experts warn that it could introduce different kinds of pollution in the manufacturing process.

Super Glue reacts with a lot of different materials, says Allison Christy, a graduate research assistant at Boise State University in Idaho and lead author of the new study. This is ideal if you're creating an adhesive because it would produce short polymers that increase elasticity. For plastic-making, however, you need long polymers to maintain durability.

The first challenge with Super Glue is stretching out its reaction time. To create long polymers, you need a longer reaction time. The authors screened for weakly bonding substances (known as initiators in chemistry) and co-reactants that would not produce a new compound once it made contact with Super Glue. They ultimately settled on acetone as their initiator with a small amount of dimethyl sulfoxide (DMSO), a colorless liquid that dissolves most organic and inorganic compounds.

Another issue the team needed to address was where to set off the reaction. Because Super Glue sticks to mostly everything, they needed a container that would not react with ethyl cyanoacrylate and let them get the plastic out without sticking to the walls. The solution: Tupperware. "Super Glue doesn't stick well to things like polypropylene and polyethylene," which are the main plastics in Tupperware, says Scott Phillips, a professor of materials science and engineering at Boise State University and author on the study.

Next, the team came up with a reaction that slowed down the reactivity of Super Glue, lengthened the bonding time between molecules, and created longer polymers. Once they had their resulting plastic—polyethyl cyanoacrylate or PECA—they had to work on strengthening it. Christy did this by annealing the substance, or heating it for 20 to 30 minutes to improve its mechanical properties. The thermal properties of PECA also

allowed the researchers to mold the plastic into different shapes, such as a bowl.

The final step focused on sustainability. The researchers wanted to design a plastic that could be converted back to the raw materials, creating a closed-loop system that reduces waste. To do so, they heated the PECA to 410 degrees Fahrenheit to break the bonds holding the polymer together, along with a dehydrating agent called phosphorous pentoxide to remove any accidentally formed water.

The process provided a 93-percent yield of the original monomers—a "pretty shocking" result, Phillips says. "The Superglue monomer is just so reactive and I assumed it would react with everything. But it's also volatile, so under these conditions of heating, it evaporated and that immediately separates it from all the stuff that it would normally react with." Because materials like acetone and DMSO are cheap and readily available, Christy expects the yield to be even higher if done in an industrial setting.

"This is an interesting paper reporting on synthesizing new polymers, and may provide useful properties for use in plastics applications," says Ramani Narayan, a professor of chemical engineering and materials science at Michigan State University and expert in bioplastics, who was not involved in the study. However, he cautions that PECA could have the same issue as other non-degradable plastics and potentially shed microplastics that would accumulate in the environment.

That's not the only pollution concern Narayan has. He says one of the reaction steps involves evaporating chemicals like acetone, which in turn allows residual solvents to be emitted into the air. This could be an issue in manufacturing plants that carry strict guidelines for volatile organic compound emissions. Additionally, Narayan notes that two of the ingredients needed to make ethyl cyanoacrylate are chloroacetic acid and sodium cyanide, and are "not generally considered safe [for human health] or environmentally responsible."

The study does bring up an important question: What's the best way to deal with plastics? There are an estimated 8.3 billion tons of plastic in the world today. While green efforts encourage people to reduce, reuse, and recycle, about 79 percent of plastic sit in landfills because they are unrecyclable. For example, polystyrene is a petroleum-based plastic that is difficult to break down. Yet, it's a common and versatile plastic that's used in everyday products such as yogurt cups and single-use spoons. The study authors note that it makes up six percent of total plastic waste. "If people could use [PECA] instead of the polystyrene for various

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applications, in theory, it should reduce that six percent because we'd be able to recycle [the plastic] back to starting material again," explains Phillips.

"We can't get rid of plastic entirely. It's impossible. It's one of the most valuable materials to society," adds Christy. "If we can use creative approaches and rethink plastic and some of the other materials around us, there are solutions out there worth pursuing."

Popular Science, 23 March 2023

https://popsci.com

ChatGPT can now access the internet and run the code it writes

2023-03-24

Language model AIs teach themselves the arts of communication and problem solving based on a limited set of training data. In the case of GPT-4, that data is quite out of date, with the cutoff being late 2021. That's where all of ChatGPT's "knowledge" has come from up to this point, and its only output – at least in the service the public can use – has been text. Now, with today's launch of a plugin ecosystem, GPT levels up again with some impressive new abilities.

OpenAI has allowed its stunning ChatGPT AI to reach out into the world with staggering new powers.

First of all, it's now got access to the internet, meaning it can go surf the Web looking for answers if it determines you need up-to-date information that's not in its knowledge base. To do this it formulates relevant search strings, sends them to Bing, looks at the results, then goes and reads links it deems worthy until it decides it's got a good answer for you. You can watch exactly what it's up to while it does this, and when your answer comes back, it's neatly annotated with links you can click on to go and examine the relevant sources yourself.

For the time being, its web browser activities are read-only beyond sending "get" requests to Bing. It can't fill in forms, or do anything else online – so it can't quietly go and set up unshackled copies of itself on some hidden server somewhere and start engaging in the kinds of "power-seeking behavior" it's already been caught exhibiting.

Still, OpenAI is keeping everything that happens within its search API separate from the rest of its infrastructure just to be sure. It can't visit websites that aren't available through Bing's "safe mode," and it won't visit sites that request not to be crawled in their robots.txt files.

Secondly, it can now run the code it writes. OpenAI has given it a working Python interpreter, sitting in a "sandboxed, firewalled execution environment," along with some disk space, which stays available for the duration of your chat session, or until it times out. It can also now upload and download files.

So if you ask it a question that requires some serious number crunching, it's now capable of coding up a piece of software specifically for the task, and running that code to complete your task. You can supply it with data in certain file formats, and it'll perform operations on that data and give you something back again, potentially in a different format if that's what you ask for.

This is pretty bonkers stuff. It'll take a spreadsheet and make annotated graphs for you. It'll accept JPGs, tell you what they look like they are, and write and run code to resize those images or convert them to grayscale.

And it gets access to a bunch of initial third-party plugins, with tons more to follow. For example, Expedia, OpenTable and Kayak plugins can search for and set up bookings for flights, restaurants, accommodation and rental cars. Instacart, Klarna and Shop plugins can find and compare products, and set up orders. A Wolfram|Alpha plugin gives GPT access to math and computing powers, as well as streams of real-time data.

At this stage, it appears its capabilities are mainly limited to setting things up rather than making actual transactions with your money; you'll have to click through and handle the money stuff yourself.

Finally, a Zapier plugin acts as a gateway through which GPT can now access some 5,000 other apps, including Gmail, Google Sheets, Trello, HubSpot and Salesforce. This begins to position GPT as the ultimate personal assistant, with access to a huge amount of your personal and company information, and potentially the permissions to get in and perform a range of tasks for you. Extraordinary stuff.

These plugins are gradually becoming available to paid users and developers through a waitlist. And new plugins are going to proliferate at extraordinary speed, since nobody even needs to code them. "You write an OpenAPI manifest for your API, use human language descriptions for everything, and that's it," tweeted developer Mitchell Hashimoto. "You let the model figure out how to auth, chain calls, process data in between, format it for viewing, etc. There's absolutely zero glue code."

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The pace of progress at OpenAI has been absolutely dizzying in the last few months. It seems like this insanely advanced AI gets a massive overhaul with extraordinary new abilities every time we blink. These new plugins represent ChatGPT beginning to reach outside the cage it's kept in and operate on the real world.

For now, its capabilities will be extremely limited, because OpenAI knows more about the potential dangers of this exceptional technology than anyone. But assuming these guys are the good guys, and they've taken the time to make sure this is done safely, GPT's massively disruptive appearance will certainly force other, less principled and less capable actors to rush to develop competing AIs, and give them competing powers.

The opportunities here are absolutely incredible – and the risks are unprecedented with every step this technology takes. We're well into uncharted territory at this stage, with very limited forward vision and the accelerator pedal jammed to the floor. What a time to be alive.

New Atlas, 24 March 2023

https://newatlas.com

Incredible Potential: A New Way To Prevent Common Causes of Vision Loss

2023-03-23

Scientists at UVA Health have uncovered a previously unknown factor that contributes to the harmful growth of blood vessels in the eye. This breakthrough could pave the way for new treatments for macular degeneration and other common causes of vision loss.

Jayakrishna Ambati, MD, and Shao-bin Wang, Ph.D. of UVA, along with their colleagues, have pinpointed a new target in their efforts to halt the development of abnormal blood vessel tangles associated with eye conditions like neovascular age-related macular degeneration, proliferative diabetic retinopathy, and ischemic retinal vein occlusion.

"Our study has opened up the possibility of mitigating aberrant blood vessel growth in eye diseases by targeting the epigenetic machinery," said Ambati, the founding director of UVA's Center for Advanced Vision Science and a member of the University of Virginia School of Medicine's Department of Ophthalmology.

"Current strategies for treating ocular neovascular disorders are not perfect."

"Through local targeting of the epigenetic regulator, we have gained a deeper understanding of how ocular immune cells can cause a loss of control over blood vessel growth under the retina. This approach also offers a new direction for the development of more effective, cost-efficient, and accessible interventions, thereby avoiding issues such as drug resistance, which is a growing concern with conventional anti-VEGF therapies used in clinical treatments."

Understanding Vision Loss

Scientists have known that abnormal vessel overgrowth in the eye is fueled by excessive amounts of a substance called "vascular endothelial growth factor-A," or VEGF, that plays an important role in blood vessel formation. There are now treatments available that target VEGF to prevent vessel overgrowth, and they often provide dramatic benefits at first. Unfortunately, these benefits can fade with time. That leaves doctors in need of better treatments to help preserve patients' eyesight.

Ambati and Wang's new research identifies a key protein that determines VEGF levels. Blocking this protein in lab mice reduced their VEGF levels significantly, and it did so in a targeted way, without unwanted side effects. The scientists noted, for example, that they observed no toxic effects on the retina, the light-sensing portion of the eye where the vessel overgrowth occurs.

"This fat mass and obesity-associated (FTO) protein was previously shown to be correlated with obesity in humans. Unexpectedly, we found it also play important roles in regulating ocular neovascularization through an epigenetic mechanism," Ambati said. "This exciting discovery finally answers a longstanding question about how ocular immune cells, such as macrophages, contribute to abnormal blood vessel growth under the retina. This question was first investigated by our team 20 years ago, and we're thrilled to have found an answer."

In addition to identifying a promising target for the development of new treatments for vision loss, the discovery sheds important light on the fundamental mechanisms responsible for the blood vessel overgrowth that robs millions of people of their sight. Neurovascular age-related macular degeneration alone affects more than 200 million people worldwide. While much more research and testing will be needed before the new finding could be translated into a treatment, the UVA scientists are excited about the potential of the discovery.

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"Current strategies for treating ocular neovascular disorders, which primarily focus on regulating the protein levels of VEGF, are not perfect. Therefore, it is imperative to identify more targetable candidates to develop alternative therapies," Wang said. "We are hopeful that our study will pave the way for the development of new treatments, ultimately reducing the burden of neovascular-related illnesses."

Sci Tech Daily, 23 March 2023

https://scitechdaily.com

Robotic beehive provides vital life support to chilly honeybees

2023-03-23

While honeybees are famously difficult to study, altering natural behaviors if any outside influences are sensed, they're also incredibly susceptible to colony collapse due to the cold. If hive temperatures drop below 50 °F (10 °C), the bees cease buzzing and generating their own heat, and slip into a deadly state of chill coma.

A robotic hive was able to help honeybee colonies endure through extreme winter weather.

So in a win for both bees and ecologists, a team of roboticists and biologists from École Polytechnique Fédérale de Lausanne (EPFL), in Switzerland, and the University of Graz, in Austria, have developed a robotic honeycomb that both keeps the bees toasty during cold snaps and also allows them to be studied.

The robotic beehive device was designed to slip unobtrusively into an existing hive, and in it a central processor coordinated sensors, sent commands to the actuators and sent data to the team watching from afar. With its thermal sensors and actuators, the robotic beehive was able to measure and steer honeybee behavior by switching up the localized temperature.

"Many rules of bee society – from collective and individual interactions to raising a healthy brood – are regulated by temperature, so we leveraged that for this study," explained first author Rafael Barmak, PhD student at EPFL. "The thermal sensors create a snapshot of the bees' collective behavior, while the actuators allow us to influence their movement by modulating thermal fields."

Heat is also sent into the honeycomb connected to the robotics, and it's gentle enough to not bother the bees but allows scientists to thermoregulate the colony. Testing the system on 4,000 bees they

encouraged to move into this high-tech home, the team was able to keep the colony alive during a 2020-2021 cold snap when nearby hives died out.

"Previous studies on the thermal behavior of honeybees in winter have relied on observing the bees or manipulating the outside temperature," added Martin Stefanec, from the University of Graz. "Our robotic system enables us to change the temperature from within the cluster, emulating the heating behavior of core bees there, and allowing us to study how the winter cluster actively regulates its temperature."

The "biohybrid superorganism" is an exciting step for studying populations and positively, light-handedly influencing behavior rather than disrupting and upsetting balances in animal communities.

"By gathering data on the bees' position and creating warmer areas in the hive, we were able to encourage them to move around in ways they would never normally do in nature during the winter, when they tend to huddle together to conserve energy," said Mobile Robotic Systems Group head Francesco Mondada. "This gives us the possibility to act on behalf of a colony, for example by directing it toward a food source, or discouraging it from dividing into too-small groups, which can threaten its survival."

And by distributing heat through the actuators, the scientists were also able to prolong the survival of a colony despite it losing its queen. While it's still in its early stages, the robotic hive shows promise in being able to mitigate colony collapse due to chill coma, and also offers new behavioral insights and knowledge for conservation scientists.

The study was published in the journal Science Robotics.

New Atlas, 23 March 2023

https://newatlas.com

Marine Heat Waves Can Happen Even At The Bottom Of The Ocean, New Study Finds

2023-03-22

There's been a lot of news in recent years about marine heat waves, which warm up ocean surface waters and harm habitats and sea creatures like crabs, fish and coral.

Now, new research from the National Oceanic and Atmospheric Administration shows that same type of ocean warming, fueled by global warming, is also happening deep underwater.

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We talked via email to Dillon Amaya, a research scientist with NOAA's Physical Science Laboratory and lead author on the study, about what the findings mean and why they are important.

Here's what we learned.

Creatures on the sea floor are especially vulnerable to temperature changes.

The new study looked at temperature extremes along continental shelves on the bottom of the ocean. Those areas hadn't been targeted in previous studies, but more sophisticated computer modeling is making it easier to do so. That's important because these areas are home to habitats for critical commercial species including lobsters, scallops, crabs and flounder.

"There are a lot of sea critters that are either rooted to the sea floor, or primarily live near the ocean bottom," Amaya said. "Living so deep in the water column, they are really attuned with the temperature conditions there, so when a heat wave happens it can really impact them."

Marine heat waves have ripple effects from the ocean floor to local communities.

"Corals can bleach, the metabolisms of different fishes can increase and cause them to burn energy faster than they can eat. All of which can lead to die-offs," Amaya said. "In 2015, the Pacific cod industry in the Gulf of Alaska saw a 70% decline in response to a heat wave. In 2018, there was a big decline in snow crab in the Bering Sea. These are $100-$200 million fisheries, so it can really take an economic toll."

Marine heat waves can damage habitats and lead to die-offs of marine life.

They can also make habitats more hospitable to invasive species like lionfish, which prey on and compete with native species.

Global warming is heating up the ocean.

Oceans cover 70% of the planet. Greenhouse gases trap heat radiated from the Earth's surface and prevent it from being disbursed into space. As greenhouse gas emissions have risen in the past 140 years, so have Earth's temperatures.

"The oceans take up 90% of the excess heat associated with global warming," Amaya said. "Marine heat waves (both at the surface and at the ocean bottom) are getting hotter as a result. It's an open science question whether marine heat waves themselves, the actual physical phenomenon, are becoming more frequent or intense, but they are definitely becoming hotter and it's because of global warming."

Deeper waters warrant a deeper look.

Amaya and his fellow researchers found that bottom marine heat waves tend to last longer than surface marine heat waves. They can occur at the same time as surface heat waves, or come on with no signs of heating in the waters above.

"The scary thing about bottom marine heat waves is that they can happen without a clear surface signature," Amaya said. "That makes them really hard to prepare for because we often don't know that one is happening until the marine ecosystem impacts are apparent. We need better, more widespread and more consistent observations at the bottom of the ocean to see these things coming."

The Weather Company, 22 March 2023

https://weather.com

How much does a galaxy cluster weigh? AI found a secret equation

2023-03-27

There's no scale large enough in the universe to 'weigh' a cluster of galaxies. To find out their mass – much of which is the elusive dark matter – scientists must estimate based on particular observations.

But a new paper published in PNAS has outlined how artificial intelligence was able to uncover a simple tweak that allows a better estimate of these huge galaxy clusters' mass.

"It's such a simple thing; that's the beauty of this," says study co-author Francisco Villaescusa-Navarro, a computational astrophysicist at the Flatiron Institute.

"Even though it's so simple, nobody before found this term. People have been working on this for decades, and still they were not able to find this."

This important, because understanding these galaxy clusters is vital to understanding the evolution of our Universe.

Measuring total mass is difficult though, particularly because dark matter – the stuff that makes up most of the cluster's mass – is invisible.

The current method works because as gravity squashes matter together, the matter's electrons push back. This changes the way electrons act with

No scales and too much dark matter.

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photons, and by measuring these photons, scientists can estimate the mass of the galaxy cluster.

But when the new researchers used an AI tool called "symbolic regression" to try and come up with a better, more accurate method, the AI came up with an equation with a new term added.

This new term focuses the analysis less on the cores of galaxies, and more on the reliable outer regions. This means that the AI equation was able to better predict the mass of the clusters.

"In a lot of cases in astronomy, people make a linear fit between two parameters and ignore everything else," says first author Digvijay Wadekar, from the Institute for Advanced Study.

"But nowadays, with these tools, you can go further. Symbolic regression and other artificial intelligence tools can help us go beyond existing two-parameter power laws in a variety of different ways, ranging from investigating small astrophysical systems like exoplanets, to galaxy clusters, the biggest things in the universe."

The research has been published in PNAS.

Cosmos, 27 March 2023

https://cosmosmagazine.com

"Smart" bandage could one day monitor and medicate chronic wounds

2023-03-27

If left untreated, chronic wounds such as diabetic skin ulcers can become infected, ultimately leading to amputations or even death. An experimental new "smart" bandage is designed to help keep that from happening, by both watching and treating such injuries.

Taking the form of an electronic skin-adhered patch, the dressing is being developed at the California Institute of Technology by a team led by Asst. Prof. Wei Gao.

It incorporates a flexible, stretchable, biocompatible polymer substrate, on the underside of which is an array of sensory electrodes, a pair of voltage-modulated electrodes, and a layer of drug-loaded hydrogel. Mounted on top of that substrate is a small, flexible printed circuit board which

The bandage uses its voltage-modulated electrodes to trigger the release of medication from the hydrogel.

contains electronics such as a battery, Bluetooth chip, and temperature sensor.

Once applied directly to a wound site, the bandage continuously uses its sensors to check the concentration of chemicals like uric acid, ammonium, glucose and lactate – plus it checks for changes in the wound's pH and temperature – all of which are indicators of infection or inflammation.

If any such indicators are detected, the bandage responds by sending an alert to a nearby smartphone or other device. It also uses its voltage-modulated electrodes to trigger the release of medication from the hydrogel, and to deliver a low-voltage electrical current to the wound bed, stimulating the regrowth of new tissue.

In lab tests performed on rats, the technology proved to be successful at accurately relaying wound-status data, killing harmful bacteria such as E. coli, and at speeding the healing of chronic wounds similar to diabetic skin ulcers. Plans now call for human trials to be conducted.

"We have showed this proof of concept in small animal models, but down the road, we would like to increase the stability of the device but also to test it on larger chronic wounds because the wound parameters and microenvironment may vary from site to site," said Gao.

A paper on the research was recently published in the journal Science Advances.

New Atlas, 27 March 2023

https://newatlas.com

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

CHEMICAL EFFECTS

Associations between per- and polyfluoroalkyl substances (PFAS) and diabetes in two population-based cohort studies from Sweden

Individual and joint effects of phthalates exposure on the risk of early miscarriage

Joint effects of temperature and copper exposure on developmental and gene-expression responses of the marine copepod Tigriopus japonicus

ENVIRONMENTAL RESEARCH

Occurrence, source estimation, and risk assessment of Polycyclic Aromatic Hydrocarbons in coastal seawaters from the Quintero Industrial Complex (Valparaíso, Chile)

Using blood lead concentrations of wildlife sentinels to identify environmental risk factors of lead exposure for public health and wildlife rehabilitation efforts

Air pollution and stroke hospitalization in the Beibu Gulf Region of China: A case-crossover analysis

PHARMACEUTICAL/TOXICOLOGY

Prediction of in vivo prenatal chlorpyrifos exposure leading to developmental neurotoxicity in humans based on in vitro toxicity data by quantitative in vitro-in vivo extrapolation

Occurrence of legacy and alternative per- and polyfluoroalkyl substances in serum from high exposure population and their disrupting effects on serum lipids and thyroid function

OCCUPATIONAL

Assessment of occupational health risk due to inhalation of chemical compounds in an aircraft maintenance, repair, and overhaul company

Characterization of welding fume and airborne heavy metals in electronic manufacturing workshops in Hangzhou, China: implication for occupational population exposure