CHEMWATCH

Bulletin Board

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CURIOSITIES

TECHNICAL NOTES

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ASIA PACIFIC

Migration of chemicals and microplastics from microwavable parts

2021-06-09

In a research article published on May 11, 2021, in the peer-reviewed *Journal of Hazardous Material*, Ying-Jie He and colleagues from *Yunnan University*, Kunming, China, provide an overview on intentionally added substances (IAS) as well as on non-intentionally added substances (NIAS, FPF reported) and microplastics (MPs) migrating from microwavable plastic food containers (MPFCs) to evaluate potential exposure to humans.

The scientists selected 15 popular MPFCs made of polypropylene (PP), styrene-acrylonitrile copolyester (SAN), or Tritan and performed chemical migration experiments according to standard procedures for testing plastic food contact materials in the *European Union* (FPF reported), including microwave heating. In total, they identified 42 IAS and over 100 NIAS using ultra high performance liquid chromatography electrospray ionization quadrupole time-of-flight mass spectrometry (UHPLC-ESI-Q-TOF/MS). Identified NIAS included Cramer class III toxic compounds such as the antioxidant Irgafos 168 OXO (CAS 95906-11-9), previously observed in migrates of polypropylene films (FPF reported), as well as isomers of hexadecanamide and oleamide. For some MPFCs, the concentration of these compounds exceeded the threshold at which they are estimated to be of toxicological concern. However, the application of the MPFCs to a 2nd and 3rd migration step suggests that repeated ethanol treatment before application can reduce the migration of chemicals to levels complying with regulation. In addition, the researchers quantified the MPs migrating into distilled water upon microwave heating. Individual samples contained more than one million particles per liter, but MP levels varied strongly across the respective samples. Based on the experimental data, the study found that the consumption of take-out food once a day "might result in an annual intake of IAS/NIAS up to 55.15 mg and 150 million MPs particles."

For some MPFCs, the concentration of these compounds exceeded the threshold at which they are estimated to be of toxicological concern.

The authors conclude that there is a "significant gap in the available experimental data used to evaluate the comprehensive hazards and risks" of MPFC products and that "reliable risk assessments both of chemicals and MPs should be based on actual data in future research."

Read More

Food Packaging Forum, 9 June 2021

https://www.foodpackagingforum.org/news/migration-of-chemicals-and-microplastics-from-microwavable-plastics

Do you have new duties under Victoria's amended environmental laws?

2021-06-16

If you live or do business in Victoria, the answer is yes.

On 1 July 2021, the sweeping amendments to the Victorian environmental regulatory framework, which have been the subject of much discussion over the past few years, will finally come into effect.

The new environmental laws change the way environmental risks are dealt with under the *Environment Protection Act 2017 (Vic) (the **EP Act**) and how breaches are managed by the Environment Protection Authority Victoria (**EPA**).*

These laws focus on the prevention of environmental damage by introducing a General Environmental Duty (**GED**) on all Victorians. So, it is important that you and your business are aware of the changes and what you need to do in order to comply.

This is particularly so, given that a breach of the GED could lead to civil or criminal penalties, even if you have not actually caused any harm – the duty is breached whenever there is a **risk** of harm that is not being proportionally managed.

The new GED should be familiar if you conduct a business in Victoria as it is modelled on the equivalent duty in Victoria's occupational health and safety legislation. The process of identifying hazards and risks is very similar, as is the requirement to implement 'reasonably practicable measures' to eliminate or reduce those risks.

The EPA has released guidance material for different industries about how the GED can be complied with in the relevant industry and gives examples for industry-specific risks and how they can be managed.

Further, the Final Draft of the Regulations provides significant additional detail and prescribed information to support the interpretation of the EP Act.

These laws focus on the prevention of environmental damage by introducing a General Environmental Duty (GED) on all Victorians.

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Meg Lee, a partner in our Melbourne office, has set out a detailed description of the new laws and what you need to do in order to comply with them in her article, 'Countdown to Victoria's new era in environmental law: are you ready?'.

Read More

Lexology, 16 June 2021

https://www.lexology.com/library/detail.aspx?g=fddafe9e-3dad-4fa5-b4a9-91b19810cdba

Updates to Module Descriptors

2021-06-16

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has updated the following Module Descriptors to clarify the circumstances when particular modules should be applied.

The changes relate to:

removing reference to a residues module from the pathway '*Apply for approval of an active constituent only*', as this module is relevant for product registration but not active constituent approval

providing for the application of a work health and safety Module 6.1 for the pathway '*Apply to register a new product that contains an approved active constituent*' for agricultural products, but only where it is the first time the approved active constituent is being used in a product

clarifying the use of the finalisation modules when an application requires consideration of a number of modular assessment reports prepared as part of a previous application (either an Item 25 application or a previously refused or withdrawn application).

The Module Descriptors were designed to inform the APVMA and applicants on which modules should apply for different types of applications. Assessment fees and assessment periods are based on the modules and module levels recommended by the guideline.

Any questions on the use of this guideline should be directed to enquiries@apvma.gov.au

Assessment fees and assessment periods are based on the modules and module levels recommended by the guideline.

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APVMA,16 June 2021

https://apvma.gov.au/node/86906

AMERICA

A recently introduced bill would significantly alter the GRAS process if passed

2021-06-11

House Appropriations Committee Chair Rosa DeLauro (D-CT-03) recently introduced new legislation that would significantly alter the GRAS (generally recognized as safe) process. In the new legislation, called the Toxic Free Food Act, manufacturers will be required to notify the Secretary of Health and Human Services of their GRAS determinations, and each determination will be made publicly available on the FDA website. The Secretary and the public will then have a period of at least 90 days to review each determination and object to them, if necessary. Additionally, synthesized, and novel substances would be prohibited from being GRAS, and the new bill will create a process by which the Secretary can reassess any substance that has been determined to be GRAS, if the determination did not meet the revised standards set forth in the bill.

The Secretary and the public will then have a period of at least 90 days to review each determination and object to them, if necessary.

Under the current GRAS process, manufacturers independently perform safety reviews to determine that the substance is reasonably certain not to be harmful under the conditions of its intended use, based on common scientific knowledge, but may choose whether or not to inform FDA of this determination. As such, consumer advocates have criticized the regulation as lacking transparency and effectiveness, as well as being unethical. The Center for Food Safety (CFS; Washington, D.C.), for example, has endorsed the new legislation for these reasons.

"For years, FDA has allowed food and chemical companies to decide whether long-lasting toxic chemicals, such as PFAS or orthophthalates, are safe to eat. The Toxic Free Food Act will make FDA take charge of food safety instead of the industry," said Jaydee Hanson, policy director at CFS, in a press release. CFS, along with the Center for Food Safety, Breast Cancer Prevention Partners, Center for Science in the Public Interest, Environmental Working Group, and Environmental Defense Fund sued the Department of Health and Human Services and FDA to challenge the

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GRAS final rule in 2017. The legislation remains under review in federal court.

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Nutritional Outlook, 11 June 2021

https://www.nutritionaloutlook.com/view/a-recently-introduced-bill-would-significantly-alter-the-gras-process-if-passed

NGOs petition US FDA to ban PFAS in food packaging

2021-06-03

On June 3, 2021, a coalition of NGOs in the United States including the *Environmental Defense Fund, Center for Food Safety, Breast Cancer Prevention Partners,* and the *League of Conservation Voters*, sent a petition to the *US Food and Drug Administration (FDA)* calling on the agency to ban "all long- and short-chain per- and polyfluoroalkyl substances (PFAS) as food contact substances" and to, unless evidence exists otherwise, systematically reassess previous positions based on a presumption that all per- and polyfluorinated compounds bio-persist in the human body.

The FDA began phasing out long-chain PFAS in food packaging in 2012 but continued to allow short-chain PFAS due to initial research that they were safer.

The *FDA* began phasing out long-chain PFAS in food packaging in 2012 but continued to allow short-chain PFAS due to initial research that they were safer. However, in May, *The Guardian* reported that companies such as *DuPont* and *Daikin* lied about the safety of short-chain PFAS to the *FDA,* purportedly hiding research "that suggested toxicity to lab animals' livers and kidneys at low exposure levels." Evidence is mounting that PFAS are linked to a wide array of negative health outcomes and environmental contamination (FPF reported, also here and here).

PFAS has most often been added to paper and other plant-fiber food packaging to make them water and grease resistant. The US states of Maine, Washington, Vermont, and New York are limiting the use of PFAS in food packaging within their jurisdictions, but there is no comprehensive federal PFAS regulation (FPF reported here and here). US Representative Debbie Dingell from the State of Michigan hopes to change that by introducing federal legislation within the next few weeks to ban PFAS in food packaging in the United States. If she does, this will be her second attempt to pass federal PFAS legislation.

Read More

Food Packaging Forum, 3 June 2021

https://www.foodpackagingforum.org/news/ngos-petition-us-fda-to-ban-pfas-in-food-packaging

The "Everywhere Chemical"—Might phthalates become the next PFAS?

2021-06-16

Mounting public and regulatory concerns regarding widespread phthalate exposure may result in a rapid expansion of regulatory and litigation risk for impacted businesses.

TAKEAWAYS

Phthalates are chemicals found in a wide range of consumer and industrial products, and public consciousness regarding the health risks they pose is quickly mounting.

As demonstrated in the case of PFAS, growing public concerns about chemical exposure can result in the widespread adoption of disparate regulatory standards and create unexpected litigation risks.

Some phthalates are already subject to regulation under federal environmental statutes, and some states have recently taken measures to restrict the use and disposal of phthalates.

Introduction

The term "phthalate" denotes a class of chemicals that have been used since the 1920s to improve the flexibility and durability of plastic. Accordingly, phthalates can be found in hundreds, if not thousands, of everyday products, ranging from food packaging to toys, medical devices, construction materials, textiles, cosmetics, soaps, and fragrances. Their ubiquity has led some to nickname them the "Everywhere Chemical."

Phthalates are coming under increased scrutiny due to growing concerns that they present long-term health risks. Phthalates such as di(2-ethylhexyl)phthalate (DEHP), butyl benzyl phthalate (BBP), and di-n-butyl phthalate (DBP), are suspected endocrine disruptors. There are also broader concerns that phthalates may have adverse impacts on the reproductive system and contribute to obesity and attention deficit disorder. These concerns have been recently publicized in mainstream

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outlets. For example, earlier this year, Simon and Schuster published the book *Count Down* by scientist Shanna Swan, which emphasized the potentially adverse impacts that phthalates may have on human fertility and development. This story was then picked up by leading media outlets such as *The New York Times*, *Washington Post*, ABC News, and *The Economist*. Concerns over phthalate exposure from food containers also rose during the pandemic, as Americans increased their consumption of takeout food.

Given their widespread use and the mounting concerns regarding human exposure, there is reason to believe that phthalates—and plastics in general—may be the next "hot topic" in environmental law. Indeed, there are parallels between the situation regarding phthalates today and that regarding poly- and perfluoroalkyl substances (PFAS) for several years. Therefore, it is worthwhile to consider the current regulatory and litigation landscape pertinent to phthalates.

I. Existing Framework for Federal Regulation of Phthalates

In a sense, the current framework for regulating phthalates at the federal level is more advanced than that for regulating PFAS. For example, the Consumer Product Safety Commission (CPSC) prohibits eight specific phthalates—including DEHP, BBP, and DBP—from being present in children's toys at a concentration exceeding 0.1 percent by weight. Similarly, the Food and Drug Administration (FDA) requires that phthalate additives be listed as ingredients of cosmetic products.

The United States Environmental Protection Agency (EPA) regulates a variety of phthalates under various statutes, as described below:

Phthalates are included on the EPA's list of total toxic organics (TTOs) under Clean Water Act (CWA) section 304 and EPA has designated phthalate esters as toxic pollutants under Section 307(a)(1) of the CWA.

The EPA has designated seven phthalates as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), thus subjecting releases of these chemicals to reporting obligations and Superfund Cost Recovery.

DEHP, DBP, and dimethyl phthalate (DMP) are listed as hazardous pollutants under the Clean Air Act.

Under the authority of the Safe Drinking Water Act (SDWA), EPA has issued health advisories for three phthalates and a conservative maximum contaminant level (MCL) of 6 ppb for a fourth, DEHP.

Particularly relevant to manufacturers are measures that EPA has taken to regulate phthalates under the Toxic Substances Control Act (TSCA). TSCA is the main statute that regulates the pre-market distribution of chemicals. EPA has subjected phthalates to heightened regulation under TSCA over the past decade or so and appears poised to impose further restrictions.

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JD Supra, 16 June 2021

https://www.jdsupra.com/legalnews/the-everywhere-chemical-might-3166633/

EUROPE

Copenhagen is building a huge island in its harbor to protect against sea level rise

2021-06-09

As the sea level rises on the shores of Copenhagen—likely by at least a foot and a half by the end of the century—the city will become more vulnerable to flooding during storms. So the government is now making plans to take a drastic step as part of its plan for protection: Over the coming decades, it will build an artificial island to hold the rising water back, while doubling as room for new housing.

"Rather than considering the need for climate-proofing and flood protection a stand-alone project, Lynetteholm combines climate-proofing with urban development," says Ole Schrøder, a founding partner at Tredje Natur, one of three design firms working on the project for By & Havn, a city-owned development company. The Danish Parliament recently voted to move forward with building the island.

The new island, roughly four-fifths the size of Central Park, will sit in the middle of the Port of Copenhagen, helping protect the city from storm surges by acting as a dam, while adding new homes for 35,000 residents. North of the island, a passage to the city's harbor will have gates that can close in the event of a major storm. Instead of tall walls to hold back the water, the island will have open spaces designed to help absorb it. The island "is planned with wide beaches and flat stretches of coast, whose absorbent edges reduce the strength of the waves and can thus be established in a lower terrain," says Schrøder.

Over the coming decades, it will build an artificial island to hold the rising water back, while doubling as room for new housing.

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Fast Company, 9 June 2021

https://www.fastcompany.com/90645186/copenhagen-is-building-a-huge-island-in-its-harbor-to-protect-against-sea-level-rise

Poland to close Europe's most polluting power plant by 2036

2021-06-09

Poland plans to close Europe's most polluting power plant by the end of 2036, according to a draft document published by local authorities.

The document, which is subject to public consultation, is part of the Lodz region's application for support from the EU's Just Transition Fund, aimed at helping regions bear the cost of shifting to a climate-neutral economy.

The move comes after energy group PGE abandoned a plan to develop an open-pit lignite coalmine in Złoczew to fuel the Bełchatów plant after concluding the project would be loss-making, the document said.

Bełchatów, whose operations were expected to be extended beyond the 2030s by output from the mine, will also now be phased out between 2030 and 2036, the document said.

"Scheduling the dates of shutting down the power units of the Bełchatów power plant … [and] abandoning the plan to exploit the Złoczew deposit are of fundamental importance for planning the future of the Bełchatów complex, its employees and the inhabitants of this region," said PGE's chief executive, Wojciech Dąbrowsk

Read m

"They are also symbolic, because the success of this project will largely determine the success of the Polish energy transformation."

PGE's coal assets, including Bełchatów and Złoczew, are due to be separated and moved to a state agency within months as part of Poland's plan to free its utilities from coal.

Poland generates most of its electricity from coal, but under rising pressure from the EU and with carbon emission costs surging, it has encouraged more investment in low-emission sources.

Bełchatów, whose operations were expected to be extended beyond the 2030s by output from the mine, will also now be phased out between 2030 and 2036, the document said.

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The Guardian, 9 June 2021

https://www.theguardian.com/environment/2021/jun/09/poland-to-close-belchatow-europe-most-polluting-power-plant-by-2036

INTERNATIONAL

Researchers propose Global Plastic Pollution Observation System

2021-06-04

On May 24, 2021, a group of researchers from over ten organizations around the world published a proposal in the peer-reviewed journal *Environmental Science and Technology* to create a Global Plastic Pollution Observation System (GPOS). The GPOS would create a standardized system to collect data on the extent of plastic pollution in atmospheric, terrestrial, and aquatic ecosystems and make that data available for evidence-based policymaking. Because most plastic pollution comes from land, the authors propose taking an "upstream-to-downstream" approach to measure not only where plastic pollution is found, and how much there is, but also where the pollution is generated and how it travels. Many local and global organizations already assess plastic pollution in one form or another, so the GPOS aims to build partnerships with stakeholders on multiple scales to co-create a cost-effective system useful to a diverse array of policy and research needs.

Plastic pollution is ubiquitous, and macro- and microplastic pieces have been measured in ecosystems and organisms across the globe (FPF reported). Currently, however, plastic pollution research is concentrated in certain regions and ecosystems and measured at many different scales which makes it difficult to combine data or coordinate policymaking. The GPOS, according to the authors, "builds on scientific advances and strives to connect and coordinate research across the atmosphere, lithosphere, hydrosphere, biosphere, and anthroposphere. Its aim is to support evidence-based policymaking and governance in the sectors that cause, and that are affected by, plastic pollution (e.g., food production)."

Specifically, the authors "envision that GPOS will be an umbrella for existing programs and initiatives" and highlight the *Arctic Monitoring and Assessment Program*'s Litter and Microplastics Expert Group, which coordinates monitoring of microplastics and litter across the Arctic, as one

The GPOS would create a standardized system to collect data on the extent of plastic pollution in atmospheric, terrestrial, and aquatic ecosystems and make that data available for evidence-based policymaking.

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potential partner. And by incorporating citizen science initiatives, GPOS "could help to identify plastic pollution sources and hotspots" that may otherwise be missed.

By working within the framework of the *Basel Convention's* newly established global plastic waste partnership, supporting the *UN* Sustainable Development Goals, and contributing to other global projects, the authors hope that creating the GPOS can "facilitate bridging the gap between the science and policy realms of global plastic pollution."

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Food Packaging Forum, 4 June 2021

https://www.foodpackagingforum.org/news/researchers-propose-global-plastic-pollution-observation-system

This is how the Restriction Roadmap can help speed up the journey towards our non-toxic destination

2021-06-17

We need to pick up the pace when it comes to banning hazardous chemicals from consumer products. The Chemical Strategy recognizes this and outlines an ambitious plan going forward. But legislation takes time. The Restriction Roadmap, based on current regulations, promises us a head start until the new system is in place.

It has been 15 years since the implementation of REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals), and 12 years since the CLP (Classification, Labelling and Packaging of substances and mixtures) regulation came into force.

Yet there are still hazardous chemicals in consumer products, a fact that worries 84% of the European population – and rightly so. This is a failure. Banning substances of concern one at a time clearly isn't getting us anywhere fast.

A stricter and more generic approach

The Chemicals Strategy for Sustainability, published last fall, acknowledges the gravity of the situation and commits to *"ensure that consumer products […] do not contain chemicals that cause cancers, gene mutations, affect the reproductive or the endocrine system, or are persistent and bioaccumulative"*.

The Restriction Roadmap, based on current regulations, promises us a head start until the new system is in place.

Read More

ChemSec, 17 June 2021

https://chemsec.org/this-is-how-the-restriction-roadmap-can-help-speed-up-the-journey-towards-our-non-toxic-destination/

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UK REACH work programme

2021-06-16

HSE, as the Agency for UK REACH, has responsibility for most of its regulatory functions, working with other government organisations to deliver them. This includes producing the UK REACH Work Programme, which describes operational work planned for 2021/22. Analysis and priority setting in this financial year will help decide future priorities.

Stakeholders can get involved in UK REACH in several ways, including consultations, accredited stakeholder organisations (ASOs) participation and informal engagement.

UK REACH Work Programme (PDF)

HSE, 16 June 2021

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

Security breach on ECHA website

2021-06-17

We have been informed that an unauthorised external user has uploaded malicious documents to the ECHA websites by exploiting a weakness in our website.

We took immediate actions to prevent any further damage, therefore currently and as temporary measure, it is not possible to access documents and pictures throughout the ECHA websites.

The unauthorised user managed to upload documents which may contain links to malicious sources in a specific folder in our system. There is no direct link in our website to such documents, they can be found only by skilfully using search engine services, therefore, you are not directly exposed to any risk.

However, if you stumble across any suspicious file – e.g. documents not at all related to ECHA business which may contain malicious content, etc. – while browsing our websites, please let us know immediately.

Since the vulnerability is isolated only to a specific action, we can reassure that any data has been secure all the time.

We are working hard for a permanent fix to the problem. We apologise for any issue caused and highly appreciate your patience, cooperation and vigilance.

Analysis and priority setting in this financial year will help decide future priorities.

REACH Update

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The ECHA team

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ECHA, 17 June 2021

https://echa.europa.eu/-/security-breach-on-echa-website

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Janet's Corner

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No matter what

2021-06-25

https://www.pinterest.com.au/pin/6333255717192654/

Creosote

2021-06-25

Creosote is the name used for a variety of products: wood creosote, coal tar creosote, coal tar, coal tar pitch, and coal tar pitch volatiles. These products are mixtures of many chemicals created by high-temperature treatment of beech and other woods, coal, or from the resin of the creosote bush. [1]

Wood creosote is a colourless to yellowish greasy liquid with a characteristic smoky odour and sharp burned taste. It is relatively soluble in water. Creosote prepared from coal tar is the most common form of creosote in the workplace and at hazardous waste sites in the United States. Coal tar creosote is a thick, oily liquid that is typically amber to black in colour. It is easily set on fire and does not dissolve easily in water. Coal tar and coal tar pitch are the by-products of the high-temperature treatment of coal to make coke or natural gas. They are usually thick, black or dark brown liquids or semisolids with a smoky or aromatic odour. Chemicals in the coal tar pitch can be given off into the air as coal tar pitch volatiles when coal tar pitch is heated. [2]

USES [3]

Wood creosote has been used as a disinfectant, a laxative, and a cough treatment, but is rarely used these ways today in the United States. It is still available as an herbal remedy, and is used as an expectorant and a laxative in Japan. Coal tar creosote is the most widely used wood preservative in the United States. It is also a restricted use pesticide and is found in medicines used to treat skin diseases such as psoriasis. Because of the current widespread use of coal tar creosote as a wood preservative and its past pesticidal applications, it is the form of creosote most likely to be present at hazardous waste sites and landfills. Coal tar, coal tar pitch, and coal tar pitch volatiles are used in several industries, including road-paving, roofing, aluminium smelting, and coking.

SOURCES & ROUTES OF EXPOSURE

Sources of Exposure [4]

General Populations

- The general population will only be exposed to creosote at low levels. Coal tar creosote is restricted for use to certified applicators only.

Creosote is the name used for a variety of products: wood creosote, coal tar creosote, coal tar, coal tar pitch, and coal tar pitch volatiles.

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- Potential sources of exposure to creosote include contact with creosote-treated wood products, incineration of creosote-treated scrap lumber, or ingestion of contaminated ground water.
- Exposure may also occur during the therapeutic use of coal tar dandruff shampoos, coal tar ointments for treatment of eczematous dermatitis or psoriasis.
- Exposure may also occur through ingestion of dietary supplements or tea that contains leaves from the creosote bush.

Occupational Populations

- Individuals who work in the wood-preserving industry make up the largest percent of the population that might be exposed to coal tar creosote.
- Exposure to coal tar pitch and coal tar pitch volatiles may occur in asphalt workers; rubber, aluminium, iron, steel and tire factory workers; and in coke-producing industries.

Routes of Exposure [4]

The routes of exposure to creosotes are as follows:

- Inhalation – Minor route of exposure for the general population. Predominant route of occupational exposure.
- Oral – Major route of exposure for the general population.
- Dermal – Major route of exposure for the general and occupational populations

HEALTH EFFECTS [5]

Acute Effects

Creosote has been involved in incidental or accidental poisoning incidents, mainly due to its use as a pesticide. Deaths occurred following ingestion of about 1 to 2 g (children) or about 7 g (adults). Symptoms included salivation, vomiting, respiratory difficulties, vertigo, headache, loss of pupillary reflexes, hypothermia, cyanosis, convulsion accompanied by oropharyngeal, intestinal, pericardial, liver and kidney damage.

Contact with creosote or creosote vapour may cause irritation of the skin. The skin may become red, papular, vesicular or ulcerated, depending on the period of exposure. Increased photosensitisation may occur, particularly on the face or hands. Vapours and contact can produce an intense burning of the membranes of the eyes and respiratory tract.

Eye contact can lead to conjunctivitis and keratitis. One or more of the following effects may be evident on short-term exposure to high concentrations of creosote:

- systemic – nausea and vomiting, diarrhoea, anorexia and difficulty in swallowing, salivation, abdominal discomfort, respiratory distress, cyanosis, pupillary changes, convulsive movements, rapid pulse or vascular collapse;
- neurological – headaches, fainting, vertigo and mental disturbances.

Chronic Effects

Chronic exposure may provide sufficient absorption to show the systemic effects listed above.

Carcinogenicity

Increased risks of developing lip and skin cancers have been observed in cohort studies of Swedish and Norwegian wood impregnators and in Finnish round timber workers. A cohort study examining 922 Swedish and Norwegian wood impregnators from 13 plants (for example railroad cross ties and telegraph poles) found a standardised incidence ratio (SIR) of 250 for lip cancers and an SIR of 237 for non-melanoma skin cancer. The risk increased with the latency; analysis by duration of exposure was not provided. According to the authors, the significantly elevated risk for lip and skin cancer could probably be attributed to the combination of exposure to creosote and sunlight. In a population-based record linkage study in Finland, elevated risks for lip cancer, SIR = 306, and non-melanoma skin cancer, SIR = 464, were found for round-timber workers [5]; the mortality for cancer of the scrotum was elevated among brick makers exposed to creosote. Prolonged skin exposure to soot and coal tar creosote has been associated with cancer of the scrotum in chimney sweeps.

Single epidemiological studies suggested a possible risk for bladder cancer, multiple myeloma, and lung cancer due to exposure to creosote. Two case-control studies suggested an increased risk of brain tumours and neuroblastoma among offspring of male workers with possible creosote exposure.

All of the epidemiological studies were based on qualitative estimations of exposure rather than on measurements. There is consistent evidence from human studies that creosote causes skin cancer, but the studies do not allow dose-response analysis.

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Creosote, from distillation of coal tar, is classified according to the GHS as Carcinogenicity Category 1B (May cause cancer).

SAFETY

First Aid Measures

- Skin: Wash thoroughly with waterless hand cleaners, olive oil or soap and water. Avoid solvents.
- Eyes: Flush eyes immediately with large amounts of water or olive oil for at least 15 minutes. Call a physician
- Inhalation: Remove to fresh air. If not breathing, give artificial respiration; preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.
- Ingestion: If conscious, first induce vomiting, then take 2 tablespoons of activated charcoal (USP drug grade) in water. Get immediate medical attention. Do not induce vomiting, or give anything by mouth to an unconscious person.

Exposure Controls & Personal Protection

Engineering Controls

Use in areas with adequate natural or local exhaust ventilation.

Personal Protective Equipment

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

- Skin Protection: Avoid skin contact whenever possible by using non-porous type gloves. For outdoor work use a waterproof sunscreen (SPF 25 or greater); reapply every 90 minutes while in direct sun. For exposed skin, use protective creams (for example: MSA's Fend AE-2, Kerodex 51, Jergens SBS-46).
- Eye Protection: Safety glasses, goggles and/or face shield.
- Respiratory Protection: Not required for properly ventilated areas. Use a NIOSH approved respirator with suitable organic vapor cartridge as necessary to control exposures above the TLV of PEL.
- Additional Recommendations: Do not take contaminated work clothing home. It is recommended that a complete soap and water shower and/or steam bath be taken at the end of each working day.

REGULATION [2,7]

United States

OSHA: The Occupational Safety and Health Administration has set an exposure limit of 0.2 milligrams of coal tar pitch volatiles per cubic metre of air (0.2 mg/m^3) in the workplace during an 8-hour workday, 40-hour workweek.

ACGIH: The American Conference of Governmental Industrial Hygienists recommends the same level for coal tar pitch volatiles.

NIOSH: The National Institute for Occupational Safety and Health recommends a maximum level of 0.1 mg/m^3 of coal tar pitch volatiles for a 10-hour workday, 40-hour workweek.

EPA: The Environmental Protection Agency requires that spills or accidental releases into the environment of 1 pound or more of creosote be reported to the EPA.

Australia

Safe Work Australia: Safe Work Australia has established a time weighted average (TWA) concentration for coal tar pitch of 0.2 mg/m^3 for a 40-hour workweek.

REFERENCES

1. http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=65&tid=18
2. http://www.atsdr.cdc.gov/phs/phs.asp?id=64&tid=18
3. https://www.vdh.virginia.gov/Epidemiology/DEE/publichealthtoxicology/documents/pdf/creosote.pdf
4. http://www.atsdr.cdc.gov/toxguides/toxguide-85.pdf
5. http://www.google.com.au/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CC4QFjAB&url=http%3A%2F%2Fwww.safeworkaustralia.gov.au%2Fsites%2FSWA%2Fabout%2FPublications%2FDocuments%2F796%2FCREOSOTE.docx&ei=fCM6U7OHCoGbkgWyq4CABA&usg=AFQjCNGlNDmxY759SSU-M-5jiaoyVTAHNQ&bvm=bv.63934634,d.dGI
6. http://www.amsa.gov.au/environment/maritime-environmental-emergencies/national-plan/Supporting-Documents/documents/CREOSOTE%20MSDS.pdf

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7. http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/772/Workplace-exposure-standards-airborne-contaminants.pdf

Humpback whale swallows lobster diver before spitting him out

2021-06-16

A humpback whale recently swallowed a Cape Cod lobster diver.

This is a highly unusual event, but one expert told Live Science that there are certain types of behaviors that could have led to the man being swallowed — such as diving too close to the whale's normal food.

Michael Packard was 45 feet (14 meters) deep in the coastal waters off Provincetown, Massachusetts, on Friday (June 11), when he was suddenly gulped inside the mouth of an enormous marine animal.

"All of a sudden, I felt this huge bump, and everything went dark," he told WBZ-TV News.

At first he thought he had been attacked by a shark, as great whites frequent the area, but he soon realized he couldn't feel any teeth.

"Then I realized, 'Oh my God, I'm in a whale's mouth ... and he's trying to swallow me,'" Packard told WBZ-TV News. "And I thought to myself 'OK, this is it — I'm finally — I'm gonna die.'" Packard's thoughts turned to his wife and his two sons, ages 12 and 15.

He estimated that he remained trapped inside the mouth of the leviathan for 30 seconds, and he was still able to breathe through his scuba respirator. But then the whale, clearly keen to remove its unwelcome, and inedible, guest, surfaced, shook its head and spat him out.

"I just got thrown in the air and landed in the water," he said. "I was free and I just floated there. I couldn't believe … I'm here to tell it."

Packard was hauled back onto his fishing boat by his topside crew mate, who had been anxiously surveying the water's surface for signs of bubbles from Packard's oxygen respirator. Astonishingly, Packard survived the biblical encounter with no greater injury than a dislocated knee.

Getting swallowed by any marine creature is hardly going to make anyone's day, but Packard was somewhat fortunate that he was grabbed by a baleen whale. Despite being one of the largest whale species — growing up to 60 feet (18 m) long, and weighing an impressive 40 tons (36 metric tons) —the school bus-size giants predominantly dine on tiny sea creatures such as small fish, krill and plankton, meaning their throats are usually only 4 to 8 inches (10 to 20 centimeters) wide. No one gobbled up by a humpback could end up in the beast's stomach, but the creature's 4 ton (3.8 metric tons) tongue could easily crush a person.

"All of a sudden, I felt this huge bump, and everything went dark," he told WBZ-TV News.

Rather than teeth, humpback whales have 270 to 400 nail-like strands called baleen plates. They hunt by opening their mouths to about 90 degrees before lunging at high speed with a swift swipe of their tails. This lunge generates drag that forces water, along with prey, into their mouths. After snapping their jaws shut, humpbacks expel water through their plates before swallowing the remaining prey.

And these whales can gulp a lot of water. "The engulfment capacity of a humpback whale is upwards of 50,000 kilograms [110,230 pounds] of water (which is typically filled with prey like fish or krill)," Jeremy Goldbogen, a biologist and co-director of the Hopkins Marine Station at Stanford University in California, told Live Science in an email. "So their expansive gulp could easily engulf a diver. I have never heard of this happening before with humans."

Another whale expert told Live Science that Packard's encounter, while unusual, was an accident that could have been caused by him swimming too close to a "bait ball" — the swirling ball that sardines form when threatened on all sides by predators.

"Bait balls can form in open water as well as near the bottom. and whales start by feeding bottom-up in many areas. They may not see an object," such as a diver, Hector Guzman, a marine biologist at Smithsonian Tropical Research Institute in Panama, told Live Science.

The only whale capable of eating an entire human is probably the sperm whale, the famed subject of Moby Dick known to swallow its prey — the 400-pound (180 kg) giant squid — whole. Once inside one of the sperm whale's four stomachs, a hapless human would likely asphyxiate on the gas before being pulped down by powerful muscles and dissolved by digestive acid. There are, however, no reliable reports of any human having ever met such a grim fate, Live Science previously reported.

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livescience.com, 16 June 2021

https://www.livescience.com

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Many cosmetics contain hidden, potentially dangerous 'forever chemicals'

2021-06-15

A new chemical analysis has revealed an ugly truth about beauty products: Many may contain highly persistent, potentially harmful "forever chemicals" called PFAS.

PFAS, short for per- and polyfluoroalkyl substances, include thousands of chemicals that are so sturdy they can linger in the body for years and the environment for centuries. The health effects of only a few PFAS are well known, but those compounds have been linked to high cholesterol, thyroid diseases and other problems.

"There is no known good PFAS," says chemist and physicist Graham Peaslee of the University of Notre Dame in Indiana.

In the first large screening of cosmetics for PFAS in the United States and Canada, Peaslee and colleagues found that 52 percent of over 200 tested products had high fluorine concentrations, suggesting the presence of PFAS, the researchers report online June 15 in Environmental Science & Technology Letters.

Cosmetic chemicals

Among over 200 tested beauty products, about half contained high levels of fluorine — a marker for potentially harmful PFAS compounds. Waterproof mascaras, liquid lipsticks and foundations were especially likely to contain lots of fluorine.

Makeup items with high levels of fluorine

Makeup type	Number of products tested	Percentage with high fluorine
All lip products (lipsticks, glosses, etc.)	60	55%
Liquid lipstick	42	62%
Foundations (liquids, creams)	43	63%
Concealers	11	36%
Other face products (blush, bronzers, etc.)	30	40%
All mascara	32	47%
Waterproof mascara	11	82%

"There is no known good PFAS," says chemist and physicist Graham Peaslee of the University of Notre Dame in Indiana.

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Other eye products (shadows, liners, etc.)	43	58%
All cosmetics tested	231	52%

The potential health risks of PFAS in makeup are not yet clear, Peaslee says. But besides people ingesting or absorbing PFAS when wearing makeup, cosmetics washed down the drain could get into drinking water (SN: 11/25/18).

Peaslee's team measured the amount of fluorine, a key component of PFAS, in 231 cosmetics. Sixty-three percent of foundations, 55 percent of lip products and 82 percent of waterproof mascara contained high levels of fluorine — at least 0.384 micrograms of fluorine per square centimeter of product spread on a piece of paper. Long-lasting or waterproof products were especially likely to contain lots of fluorine. That makes sense, since PFAS are water-resistant.

Twenty-nine products further tested for specific PFAS all contained at least four of these chemicals, but only one product listed PFAS among its ingredients. In addition to posing their own potential health risks, these compounds can break down in the body into other PFAS, such as perfluorooctanoic acid, which has been linked to cancers and low birth weights (SN: 6/4/19).

sciencenews.org, 15 June 2021

https://www.sciencenews.org

This 'living fossil' could reach 100 years

2021-06-17

Few animals live as long as humans do. The West Indian Ocean coelacanth (Latimeria chalumnae), an endangered species of fish that can grow to 2 meters long and weigh about 100 kilograms, might be a rare exception. A new study finds the underwater giant may live to be 100 years old.

To arrive at that figure, researchers counted tiny, ringlike calcium structures on the scales of coelacanths preserved in a French museum. They discovered that, like tree rings, a new calcium ring forms every year. By counting the rings, the team found the oldest specimen was 84 years old. But the researchers believe some individuals could live as long as 100 years.

In addition to having one of the longest life spans of any marine fish, the study, published today in Current Biology, also found that coelacanths age

A new study finds the underwater giant may live to be 100 years old.

slowly and do not reach sexual maturity until about 40 to 60 years old. That would be like humans reaching puberty at middle age.

The findings could help explain why there are so few coelacanths. The fish were once thought to be extinct and are often referred to as "living fossils" because of their similarity to prehistoric fish. Because they take so long to reach reproductive age and have relatively few offspring, coelacanths that die early in life may not be able to replace their population fast enough. And, the authors say, overfishing and habitat destruction are probably not helping.

sciencemag.org, 17 June 2021

https://www.sciencemag.org

U.N. warns drought may be 'the next pandemic'

2021-06-18

BRUSSELS (Thomson Reuters Foundation) - Water scarcity and drought are set to wreak damage on a scale to rival the COVID-19 pandemic with risks growing rapidly as global temperatures rise, according to the United Nations.

"Drought is on the verge of becoming the next pandemic and there is no vaccine to cure it," Mami Mizutori, the U.N.'s special representative for disaster risk reduction, told an online press briefing ahead of the report's release.

Already, droughts have triggered economic losses of at least $124 billion and hit more than 1.5 billion people between 1998 and 2017, according to a U.N. report published on Thursday.

But even these figures, it said, are "most likely gross under-estimates".

Global warming has now intensified droughts in southern Europe and western Africa, the U.N. report said with "some confidence". And the number of victims is set to "grow dramatically" unless the world acts, Mizutori said.

About 130 countries could face a greater risk of drought this century under a high-emissions scenario cited by the U.N.

Another 23 countries will confront water shortages because of population growth, with 38 nations affected by both, it said.

About 130 countries could face a greater risk of drought this century under a high-emissions scenario cited by the U.N.

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Drought - like a virus - tends to last a long time, have a wide geographic reach and cause knock-on damage, Mizutori said.

"It can indirectly affect countries which are not actually experiencing the drought through food insecurity and the rise of food prices," Mizutori said.

The U.N. expects more frequent and severe droughts in most of Africa, central and south America, central Asia, southern Australia, southern Europe, Mexico and the United States.

Ibrahim Thiaw, executive secretary of the U.N. Convention to Combat Desertification, told the Thomson Reuters Foundation that deteriorating soil, caused in part by poor land management, had brought the world close to "a point of no return".

The U.N. has not researched the effect that desertification could have on internal migration within continents but Thiaw said that it was no longer unthinkable, even in Europe.

"It is certainly a phenomenon that is happening in other parts of the world and may well occur in Europe," he said

More than 40% of the European Union's agricultural imports could become "highly vulnerable" to drought by the middle of this century due to climate change, according to a separate study here published in the journal Nature Communications this week.

reuters.com, 18 June 2021

https://www.reuters.com

Age-related cognitive decline may be linked to key blood cell protein

2021-06-20

New research published in the journal PLOS Biology is describing the discovery of a link between cognitive decline and a protein in red blood cells. The research found mice depleted of this protein suffered from rapid cognitive decline, and a potential new anti-aging therapeutic target could be possible if the same observation can be validated in humans.

"Red blood cells have an irreplaceable function to deliver oxygen to maintain bioenergetics of every single cell within our body," explains lead author on the new study, Yang Xia. "However, their function in age-related cognition and hearing function remains largely unknown."

"Red blood cells have an irreplaceable function to deliver oxygen to maintain bioenergetics of every single cell within our body," explains lead author on the new study, Yang Xia.

The new research is based on the hypothesis that a progressive decrease in oxygen supply to tissues is a key factor in aging. Adenosine receptor A2B (ADORA2B) is a protein that aids the release of oxygen from red blood cells, and to test what effect reduced levels of this protein has on cognition, the researchers developed mouse models engineered to lack this vital protein.

Using a number of cognitive and physiological tests the animals were compared healthy mice. The mice lacking ADORA2B displayed faster declines in memory and hearing as they aged compared the control animals, and when the animals were deprived of oxygen in a simulated hypoxia scenario, this age-related cognitive decline accelerated even more rapidly.

The researchers hypothesize ADORA2B is vitally important at maintaining tissue oxygenation in the brain and as we age levels of the key protein decline. This means brain aging could potentially be slowed by finding ways to maintain levels of this protein.

The idea that decreasing tissue oxygenation plays a role in the onset of brain aging and cognitive decline is still unproven. However, this new research does offer some mechanism to explain prior studies finding transplanting blood from young mice into old mice improves cognition. The research also offers clues to explain how hyperbaric oxygen treatments can generate anti-aging effects.

"Our findings reveal that the red blood cell ADORA2B signaling cascade combats early onset of age-related decline in cognition, memory and hearing by promoting oxygen delivery in mice and immediately highlight multiple new rejuvenating targets," adds Xia.

It is still very early days for this research avenue so don't expect a novel anti-aging treatment to stem from these findings any time soon. There are clues that very mild oxygen deprivation occurs with aging in human brains but much more work will be needed to explore how much of a role this plays in age-related cognitive decline. It is also unclear whether modulating ADORA2B in humans is a safe or effective anti-aging therapy. But nevertheless, this new discovery offers researchers a novel pathway to explore potential anti-aging treatments in the future.

The new study was published in the journal PLOS Biology.

newatlas.com, 20 June 2021

https://www.newatlas.com

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The edge of the solar system is a blob, 3D map reveals

2021-06-19

At the edge of the solar system is a violent frontier where two cosmic powers clash. On one side is the solar wind, the constant flood of hot, charged particles flowing out of the sun at hundreds of miles per second. On the other side are the winds of space, blowing with the radiation of billions upon billions of nearby stars.

Despite causing occasional blackouts here on Earth, the solar wind actually does a pretty good job of defending our planet (and the solar system) from the harshest interstellar radiation. As the wind gusts out of the sun in every direction at once, it forms an enormous protective bubble around the solar system that repels about 70% of incoming radiation, Live Science previously reported. (Earth's magnetic shield protects us from much of the rest).

This bubble is known as the heliosphere, and its edge (called the heliopause) marks a physical border where the solar system ends and interstellar space begins — but, unlike most borders on Earth, scientists have no idea how big it is or what it looks like. A new study, published June 10 in The Astrophysical Journal, tackles these mysteries with the first 3D map of the heliosphere ever created.

Using 10 years of data captured by NASA's Interstellar Boundary Explorer satellite, the study authors tracked solar-wind particles as they traveled from the sun to the edge of the solar system and back again. From this travel time, the team calculated how far the wind had blown in a given direction before being repelled by interstellar radiation, allowing the researchers to map the invisible edges of the solar system similarly to the way bats use echolocation, the researchers said.

"Just as bats send out sonar pulses in every direction and use the return signal to create a mental map of their surroundings, we used the sun's solar wind, which goes out in all directions, to create a map of the heliosphere," lead study author Dan Reisenfeld, a scientist at Los Alamos National Laboratory in New Mexico, said in a statement.

As the team's map shows, the heliosphere doesn't exactly stay true to the "sphere" part of its name; the barrier around the solar system is more of a wibbly-wobbly blob that's far thinner on one side than on the other.

That's because, just as our planet orbits the sun in a set direction, the sun orbits the center of the Milky Way, pushing headlong against the

…the barrier around the solar system is more of a wibbly-wobbly blob that's far thinner on one side than on the other.

interstellar wind that crosses the sun's path. In this windward direction, the distance from the sun to the edge of the heliosphere is considerably shorter than it is in the opposite direction — about 120 astronomical units (AU), or 120 times the average distance from Earth to the sun, facing the wind versus at least 350 AU in the opposite direction.

Why "at least" that amount? Because 350 AU is the distance limit of the team's wind-mapping method; the heliosphere could potentially extend much further behind the solar system than it appears on the team's map, meaning the protective bubble could be even blobbier than it seems here. Like bats in a cave, we'll have to fly even deeper into the darkness to figure that out.

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livescience.com, 19 June 2021

https://www.livescience.com

Surviving combat only to die at home: Retired Staff Sgt. Wesley Black is picking out his coffin at 35 years old

2021-06-21

White River Junction, Vermont (CNN)You can't tell by looking at him, but retired Staff Sgt. Wesley Black is about to die. He's just 35 years old.

And today he's having what he calls a good day.

"I could be dead tomorrow. I could live another six months ... It really all just depends on how my body responds to the oral chemotherapy, how much more I can squeeze out of the stone," Black told CNN in an interview in his home on Thursday.

Black has terminal colon cancer that has spread throughout his body. He survived two combat deployments to Iraq and Afghanistan with the Vermont National Guard and received numerous honors, including a Purple Heart.

Although it's difficult to definitively link individual cases of cancer and disorder to a specific cause, an oncologist outside the Veterans Affairs system who reviewed Black's case determined it's the smoldering trash from the massive burn pits on US military bases — sometimes acres in size — that will soon kill him.

"Metals, plastics, electronics, medical waste, your uniform -- anything and everything that could be burned was thrown in the trash dump and then coated in diesel fuel and lit on fire."

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"Soldiers tend to generate a lot of trash," Black told CNN. "Metals, plastics, electronics, medical waste, your uniform -- anything and everything that could be burned was thrown in the trash dump and then coated in diesel fuel and lit on fire."

se dialog"

In Ramadi, Iraq, where Black served, he says the burn pit was several football fields in length. And at the remote combat outpost where he served in eastern Afghanistan, Black recalls how the burn pit was located just 150 feet from the front gate.

"If you were the poor sucker standing gate guard when that burn pit was lit and the wind was blowing toward the main gate, you'd be standing in the smoke for upwards of eight to 12 hours a day."

Thousands of American service members have inhaled the carcinogenic haze of burn pit smoke just as he did.

A recent survey by Iraq and Afghanistan Veterans of America found that 86% of veterans from the two conflicts reported being exposed to the toxic fumes of burn pits. And 88% of those exposed said they were experiencing symptoms that could be related.

The VA acknowledges on their site that waste products disposed of in open burn pits include chemicals, paint, medical and human waste, along with things like munitions and petroleum products.

When Black medically retired in 2015 after being thrown from a Humvee in a roadside bomb attack, he thought he had survived the Iraq and Afghanistan wars.

"I thought I was on Easy Street. I was ready to chase my wife and son around for the rest of my life. Life was good," Black said.

Then the pain and severe digestive issues began.

A death sentence

Black says he complained of serious symptoms to Veterans Affairs providers for years. But he says his cancer went undetected until 2017.

The diagnosis was stage four colon cancer, a death sentence.

When Black learned he would die, he had a new baby boy. He and his wife had just bought a home with a treehouse out front in a quiet Vermont town. He was beginning a career as a firefighter.

This past spring, in the late stages of his illness, Black retired from the fire department.

But when his former coworkers drive the engine by his house, they turn on the lights and sirens, one local volunteer firefighter told CNN.

Now Black and his wife are planning a funeral, visiting the local funeral home to pick out his coffin.

"It's literally just a square pine box, and I was like that's the coffin I want," Black told CNN. "My wife looked at me with this horrified look like 'don't you dare, don't you dare make me face your entire family with this pine box' ... But I said that's what I want, that's what I want to be buried in."

The wife, per usual, won out.

As Black sought answers after his diagnosis, an oncologist outside the VA system linked his rare cancer to burn pit exposure.

The VA then granted Black 100% disability coverage for his service-related illness. It was a win. Twenty percent of burn pit-related claims filed have been granted, according to data provided by the VA.

It means the military will now pay for his funeral and the sleek silver coffin with an American flag draped over the top.

Burn pits and Beau Biden

As the post 9/11 wars come to an end in the coming months, burn pits and exposure to other toxins threaten to kill many more veterans than fighting in the wars did.

And the White House is acutely aware of the problem.

President Joe Biden, as a candidate, said he believes burn pits may have killed his beloved son Beau, who died of cancer in 2015.

"He volunteered to join the National Guard at age 32 because he thought he had an obligation to go," Biden told a Service Employees International Union convention in 2019. "And because of exposure to burn pits, in my view -- I can't prove it yet -- he came back with stage four glioblastoma."

Biden repeated this message on several campaign stops, vowing to vigorously research the long-term effects of burn pit exposure while noting that he "can't prove it yet."

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But burn pits have been on the legislative radar of the past two presidents, including bills signed into law that expand the data on exposure.

In 2013, then-President Barack Obama signed the burn pit registry into law, so that the VA could gather data on veterans' exposure to burn pits -- even if they weren't experiencing health issues at the time. High traffic plagued the launch of the registry and continually disrupted the early years of its service.

More than 200,000 names are now on that list -- including Black's.

In 2019, then-President Donald Trump signed a law that, in part, will phase out burn pits and require the Department of Defense to pinpoint where they have been used, so that information can be cross referenced with where sick veterans served.

The VA says the Department of Defense has shut down most burn pits at this point and is planning to close the remainder.

But the VA website in March 2020, under Trump, officially denied that burn pit exposure was harmful: "At this time, research does not show evidence of long-term health problems from exposure to burn pits."

Today, the VA website acknowledges the issue is being studied and that those exposed "may be at greater risk for longer-term health conditions."

In an email to CNN on Sunday, Veterans Affairs press secretary Terrence Hayes wrote: "VA is fully committed and leaning forward in this effort and working alongside Congress ... and all other available scientific sources to deliver on the President's promise to provide the world-class health care and access to benefits Veterans need, and quite frankly deserve."

Hayes urged veterans exposed to sign up for the burn pit registry and those feeling ill due to a possible toxic exposure to submit a claim.

"The more veterans who do so only helps us gather the information and research needed to provide the care they require."

A dying veteran fights

Black is demanding more.

"They're not doing enough. That's the long and short of it. There needs to be a set process to identify these issues and to follow up on these issues," Black told CNN. "If [the cancer] had been caught earlier, my survivability rate would've been higher."

Unable to save himself, Black is sounding the alarm for other veterans while pushing for additional screening of burn pit exposure and more proactive monitoring and treatment from VA providers.

"I'm kind of like the canary in the coal mine screaming my head off trying to raise awareness," he told CNN. "It's too late for me. But it's not too late for the next veteran who walks down the hall of the VA and goes in and complains about the signs and symptoms."

On his bad days, when it's hard to get out of bed, Black thinks of his wife and their five-year-old son. He uses the strength he can muster to run around and play, if only for a few minutes, in the hopes that his son will remember these moments.

"Spending time with him, building memories. I hope in 20 years he has these memories," Black said through jagged breaths. "Spending time with my wife and just telling her every day that I love her."

He spoke of fighting for them and cried.

"I'm just a dumb Irish kid from Boston. All I know how to do is fight, you know," Black said. "Cancer's gonna win, but it's gonna be one hell of a war of attrition."

This story has been updated to reflect that while Black's illness has been determined to be caused by burn pits by an oncologist outside the VA system, it is often difficult to link individual cases of cancer to a specific cause.

edition.cnn.com, 21 June 2021

https://www.edition.cnn.com

How glasswing butterflies grow their invisible wings

2021-06-22

In a small tent in the middle of Panama's rainforest, Aaron Pomerantz assembled a makeshift field lab, filled with microscopes, chemical reagents, and delicate lab equipment. At times, it was so hot that Pomerantz, an integrative biologist at the University of California, Berkeley, struggled to keep his own sweat from contaminating his delicate lepidopteran samples. He was looking for something nearly invisible—transparent butterflies known as glasswings.

The rare butterflies "are like ghosts in the rainforest," says Nipam Patel, Pomerantz's Ph.D. adviser. Now, Pomerantz and Patel have done more than just find the butterflies—they've also solved an enduring mystery: how their wings are transparent in the first place.

The rare butterflies "are like ghosts in the rainforest," says Nipam Patel, Pomerantz's Ph.D. adviser.

The glasswing butterfly (Greta oto), a baseball-size flier that lives throughout Central and South America, is one of hundreds of butterfly species with transparent wings. This rare adaptation helps it evade potential predators. Compared with other see-through species, such as dragonflies, glasswings are even more adept at fluttering through the rainforest unnoticed because their wings don't shine or glimmer in sunlight.

Patel, who normally studies arthropod evolution, has a lifelong interest in glasswings—and a collection of tens of thousands that he has assembled since the age of 8. To understand what makes the critters so stealthy, Patel, now director of the Marine Biological Laboratory in Woods Hole, Massachusetts, asked a group of graduate students to take microscopic images of the wings of a dozen or so species of transparent butterflies.

His students found that "every way you can think of being transparent, some butterfly or moth has figured out," Patel says. A butterfly's wings consist of a thin, membranous layer of a natural polymer called chitin, which is typically covered with tiny scales that resemble interlocking tiles. Species with transparent wings have found ways to move light around these scales, producing fewer of them, turning them vertically, or simply getting rid of them.

The group found that glasswings not only produce fewer scales, but they also convert many of those scales into bristles, allowing light to pass through the wings more easily. Using a scanning electron microscope, Pomerantz also discovered that tiny mounds between the bristles, known as nanopillars, are coated in a layer of wax.

The nanopillars seem to help reduce glare, Pomerantz says. Glare happens when light hits a surface and bounces off at the same angle, as if striking a mirror. The nanopillars "rough up" the surface of the wings and cause the light to bounce off at multiple angles, diffusing the reflection, the researchers wrote last month in the Journal of Experimental Biology. "Because they're so small, they act kind of like little bitty speed bumps," Pomerantz says.

In addition, the waxy coating slows down light that passes through the wings because it is more dense than air—like forcing someone to swim through molasses. That reduction in speed softens the impact of light hitting the scales, further reducing glare. Stripping the glasswings of their

waxy coating and nanopillars resulted in wings that were shiny, Pomerantz says.

Although many transparent species, including the hand-size hyperiid, have developed these microscopic speed bumps, the wax coating is a new and somewhat puzzling find, says Sonke Johnsen, a biologist at Duke University. That's because butterflies' chitin covering is strong—and the addition of the wax layer weakens it. "Why forgo those amazing advantages that you get with chitin to replace it with this wax?" Johnsen asks. "I bet there's more to the story that they're going to find out."

Understanding these antireflective properties could one day help researchers efficiently funnel light into solar panels and create cheaper antiglare lenses for cameras or glasses. But for now, Pomerantz and Patel want to focus on how glasswings evolved from nontransparent ancestors, using genomics to identify the key genes.

"It's just fascinating to know how nature solves really interesting problems like this," Patel said. "You can pay extra for glasses that have an antireflective coating on them. But, of course, essentially, butterflies figured that out maybe tens of millions of years ago."

sciencemag.org, 22 June 2021

https://www.sciencemag.org

The plastics you throw away are poisoning the world's eggs

2021-06-22

Eggs eaten by some of the world's poorest people are being poisoned by plastic waste from rich countries like Canada and the U.S., new research has found.

A suite of harmful chemicals are added to plastic and food packaging to give them desirable traits, like grease resistance or flexibility. When they burn or break down, these chemicals contaminate the surrounding environment and animals living or feeding nearby.

Chicken can absorb the chemicals by drinking contaminated water or eating contaminated worms and insects. Eggs are particularly sensitive to containing toxic chemicals and are commonly consumed by people, according to the report produced by the International Pollutant Elimination Network (IPEN), a global coalition of environmental organizations.

Chickens can absorb the chemicals by drinking contaminated water or eating contaminated worms and insects.

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The problem is most acute for people in low- and middle-income countries at the receiving end of the multibillion-dollar global trade in plastic and electronic waste. According to the recent study, which was not peer-reviewed, people eating free-range eggs raised near 25 plastic waste dumps and recycling centres in 14 low- and middle-income countries are exposed to levels of toxic chemicals far beyond safe limits to human health.

"I'm really impressed," said Max Liboiron, a professor of geography at Memorial University who specializes in plastic pollution. (Liboiron was not involved in the research.)

"These folk are looking at the mixing of plastic and e-waste in the actual conditions that the waste occurs, they're looking at the way people actually eat eggs ... and they're looking at a range of chemicals (that) exist in the real world."

It's a "really, really rare" approach, Liboiron explained, as most research into the toxicity of plastics only looks at a select few chemicals in a laboratory setting. That can make it difficult to assess the full impact plastic waste disposal and recycling have on human health and the environment. The problem is exacerbated by the chemicals' tendency to change — and often become more toxic — when exposed to heat, light and other chemicals and metals.

"The chemical that goes into plastic isn't necessarily the same chemical that comes out. It can change when you expose it to air, water, different pH, different salinities," explained Imari Karega Walker, a PhD candidate at Duke University studying the environmental impact of plastic additives.

Those factors can create a suite of chemicals that fly under industry and government safety checks on new plastic products, yet pose a danger to the environment and human health, she said. The IPEN study looked at some of those compounds in its broad assessment of persistent organic pollutants, like carcinogenic dioxins and biphynols produced from burning plastic waste, for instance.

The study's choice to assess recycling sites as well as open landfills is also important, Liboiron noted. For years, the global plastics industry has promoted recycling as a sustainable and safe way to dispose of harmful plastics. The findings point out that those promises may not be accurate.

Furthermore, they highlight the ongoing problems arising from rich countries' waste exports to the developing world.

"A lot of our waste management systems rely on exports ... the U.S., U.K., Europe (and Canada) don't have a functional waste infrastructure," Liboiron explained. "(We're) implicated, because it's quite literally our waste."

Earlier this year, Canada officially entered into the Basel Convention's plastic agreement, a global treaty restricting the international trade in plastic waste. However, critics have noted that in fall 2020, the federal government quietly signed an agreement with the U.S. to allow the free flow of plastic waste between the two countries.

Roughly 93 per cent of Canada's plastic waste exports go to the U.S., according to data by the Basel Action Network (BAN), an environmental organization. Because the U.S. isn't a signatory to the treaty, it can export Canadian plastic garbage to poorer countries.

Each month, about 25.7 million kilograms of plastic waste — mainly low-quality, unrecyclable plastic of uncertain origin — leaves U.S. shores for countries like Malaysia, Mexico and Vietnam, BAN reports. While countries have in recent years tried to stem some of the flow, which is technically illegal, many have had trouble stopping the import of trash from overseas.

In theory, if the receiving country has signed the Basel Convention — as 188 countries have — it can't accept the waste without a bilateral agreement with the U.S. However, economic pressure and a lack of enforcement can make it nearly impossible to stem the flow, according to a December investigation into the issue.

"The whole thing can be understood as waste colonialism," Liboiron said. "It's our export of waste to other places, but the reason they import our waste is because of existing colonial legacies where we've taken out anything else of value already, and now their most viable choice is to import our (trash)."

nationalobserver.com, 22 June 2021

https://www.nationalobserver.com

Australia's inaction on climate puts Great Barrier Reef 'in danger', UNESCO report says

2021-06-22

Australia's iconic Great Barrier Reef should be inscribed on a list of World Heritage Sites that are "in danger," according to a draft decision UNESCO released on 21 June. The Australian government opposes the

The Great Barrier Reef suffered major bleaching events in 2016, 2017, and 2020.

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recommendation, which was made partly to spur the country into action on climate change.

The Great Barrier Reef suffered major bleaching events in 2016, 2017, and 2020. The UNESCO report cites Australia's own studies in noting that the reef's ecosystem has deteriorated "from poor to very poor" since 2015, and that deterioration "has been more rapid and widespread" than between 2009 and 2014, partly because of repeated coral bleaching driven by global warming.

All of the 29 reefs found in World Heritage List areas have bleached multiple times, says marine ecologist Terry Hughes of James Cook University, Townsville, but UNESCO seems to be singling out the Great Barrier Reef because Australia is a laggard in addressing climate change. It has not joined the numerous other countries that have set a target of bringing net carbon emissions to zero, for example.

Although UNESCO used to consider climate change as a global issue that no one country is responsible for, there has been a "gradual shift," Hughes says, "to this new approach … to link the climate change policies of an individual country to its responsibilities for its World Heritage areas." Hughes sees the draft decision as a "warning to Australia that if it is serious about managing the Great Barrier Reef for future generations, then it has to join the rest of the world in fighting climate change." The recommendation says "accelerated action at all possible levels is required to address the threat from climate change in accordance with the Paris Agreement on Climate Change."

"Australia will strongly oppose" the recommendation, Minister for the Environment Sussan Ley said in a statement. "I agree that global climate change is the single biggest threat to the world's reefs but it is wrong, in our view, to single out the best managed reef in the world for an 'in danger' listing," Ley said. If UNESCO wants to tie heritage management evaluations to climate change, she said, "there are any number of international World Heritage Sites that should be subject to the same process."

But many ecologists welcome UNESCO's move. "This draft decision sends a powerful message that our Government needs to step up and be part of a global effort to reduce emissions," says Lesley Hughes, an ecologist at Macquarie University who is a councilor with Australia's Climate Council, a nongovernmental organization that provides independent advice on climate issues.

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The UNESCO committee had threatened to list the Great Barrier Reef as in danger in 2015 but backed down when the Australian government produced a plan to protect the reef and monitor progress annually. The government heavily lobbied members of the World Heritage Committee and issued a report in 2016 saying there was "substantial progress" in reef conditions.

The final decision on whether to add the reef to the List of World Heritage in Danger will be made by the 21 nations of the World Heritage Committee at its meeting next month in Fuzhou, China. The committee is currently chaired by China; Australia is a member. Hughes says the committee usually tries to reach unanimous decisions, but this recommendation may go to a vote that might be too close to call.

sciencemag.org, 22 June 2021

https://www.sciencemag.org

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Curiosities

A widely studied lab plant has revealed a previously unknown organ

2021-06-15

A common lab plant that's been poked and put under microscopes for decades may seem unlikely to keep secrets. But in widely studied Arabidopsis thaliana, scientists have identified the "cantil" — a newly reported plant organ named for its cantilever-like way of branching off of the main stem. The structure appears in only some A. thaliana and only under certain conditions, researchers report online June 15 in Development.

"If you told me of a new organ in a weird plant in Amazonia, I wouldn't be surprised at all," says François Parcy, a plant biologist at CNRS in Paris, who was not involved in the study. "What struck me is this happened in Arabidopsis. This is something that's really surprising."

Molecular biologist Timothy Gookin first suspected contamination or a mutation when he noticed some A. thaliana with odd stalks jutting out from the stem, like half-finished bridges. It took 12 years of experiments at Penn State to show that the rare stalks are a new type of plant part and to explain their trigger: delayed flowering.

"What struck me is this happened in Arabidopsis. This is something that's really surprising."

Like many other plants, short days prompt A. thaliana, which is in the same family as cabbage and mustard greens, to shore up resources; long days tell it to churn out flowers. Cantils form when that transition from stockpiling to blooming is postponed, as the plant keeps growing while waiting for the flowering signal, the researchers found. The cantil is "just growing kind of like, 'Hey, where's the summer? OK, I'm waiting for my break. Where's it coming?'" Gookin says.

Scientists' preference for using long growing days and fast-flowering conditions have helped keep cantils hidden in hundreds of labs worldwide, Gookin says. The organs can develop in the wild, though some favorite, fast-growing A. thaliana varieties have lost the genetic ability to produce cantils. It's unclear how the plants use the organs.

Cantils are, so far, known to occur only in A. thaliana. So the plant parts may not rewrite biology textbooks just yet. But after being found in a lab plant that's scrutinized so widely, it's a reminder to keep observing closely (SN: 10/22/18).

sciencenews.org, 15 June 2021

https://www.sciencenews.org

Pointy shoes destroyed rich people's feet in medieval England

2021-06-17

Being fashionable usually comes at a cost, and stylish people toward the end of the Middle Ages in Britain paid a steep price for wearing pointy shoes.

Pointy-shoe wearers often developed bunions, a type of foot deformity in which a bony mass forms at the base of the big toe and pushes that toe inward at an angle. While many factors can cause bunions, known medically as hallux valgus, this condition was far less common in the 13th century and earlier, when footwear styles were less extreme, according to a new study.

As these fashion victims grew older, they incurred other injuries, too. Bunions can lead to balance problems, and an examination of medieval skeletons showed that older individuals with bunions were also likely to have fractures in their upper limbs, from falls that were serious enough to break their bones.i

"The remains of shoes excavated in places like London and Cambridge suggest that by the late 14th century, almost every type of shoe was at least slightly pointed — a style common among both adults and children alike," said study co-author Piers Mitchell, an affiliated lecturer in the Department of Archaeology at the University of Cambridge.

"We investigated the changes that occurred between the high and late medieval periods, and realized that the increase in hallux valgus over time must have been due to the introduction of these new footwear styles," Mitchell said.

When a person develops bunions, the first sign of trouble is a "leaning" of the big toe toward the other toes so that it no longer points straight ahead, disrupting the toe bones' alignment, according to the American College of Foot and Ankle Surgeons (ACFAS). Bunions can develop because of arthritis or in response to other foot deformities, but the most common cause is "wearing shoes that crowd the toes," ACFAS says.

Bunions can be painful, and the symptoms are progressive; if the conditions that cause bunions persist, the problem will worsen, according to ACFAS.

Recently, scientists wondered what archaeological evidence might reveal about foot problems in people who lived centuries ago. They analyzed

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the skeletons — and bunions — of 177 individuals from four medieval cemeteries in Cambridge, England. One cemetery was for wealthy friars and parishioners, one was a charitable graveyard for the poor, one was for burials of people who were neither rich nor destitute, and one was in a remote rural parish, the researchers wrote in a study published June 11 in the International Journal of Paleopathology.

The scientists also checked the skeletons for signs of injuries that may have been caused by balance loss resulting from bunions.

They found that 27% of the individuals dating to the 14th and 15th centuries suffered from bunions. About 45% of the friars in the wealthy cemetery had bunions — the highest percentage of the group — perhaps because around the 14th century it became more common for British clergy to dress fashionably, a trend that troubled high-ranking officials in the church, said Mitchell.

"The adoption of fashionable garments by the clergy was so common it spurred criticism in contemporary literature, as seen in Chaucer's depiction of the monk in the Canterbury Tales," Mitchell added. (Chaucer dressed his monk in a fur-trimmed robe adorned with a gold pin, and the character valued material comforts more than religion).

Overall, poorer people who couldn't afford to buy impractical shoes had healthier feet, according to the study. Bunions affected only 10% of the working poor in the main parish graveyard, and just 3% of the people in the rural cemetery. In skeletons dating to the 11th to 13th centuries, before pointy-toed shoes became a fad, only about 6% of the group had bunions, according to the study.

The skeletons of bunion sufferers also showed more signs of injuries, with about 52% of bunion sufferers having at least one fracture, the researchers reported.

"Modern clinical research on patients with hallux valgus has shown that the deformity makes it harder to balance, and increases the risk of falls in older people," lead study author Jenna Dittmar, a research fellow in human osteoarchaeology at the University of Aberdeen in Scotland, said in a statement. "This would explain the higher number of healed broken bones we found in medieval skeletons with this condition," added Dittmar, who conducted the research as a postdoctoral research associate at the University of Cambridge.

"We think of bunions as being a modern problem, but this work shows it was actually one of the more common conditions to have affected medieval adults," Dittmar said.

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Killer whales form killer friendships, new drone footage suggests

2021-06-17

In the animal kingdom, killer whales are social stars: They travel in extended, varied family groups, care for grandchildren after menopause, and even imitate human speech. Now, marine biologists are adding one more behavior to the list: forming fast friendships. A new study suggests the whales rival chimpanzees, macaques, and even humans when it comes to the kinds of "social touching" that indicates strong bonds.

The study marks "a very important contribution to the field" of social behavior in dolphins and whales, says José Zamorano-Abramson, a comparative psychologist at the Complutense University of Madrid who wasn't involved in the work. "These new images show lots of touching of many different types, probably related to different kinds of emotions, much like the complex social dynamics we see in great apes."

Audio and video recordings have shown how some marine mammals maintain social structures—including male dolphins that learn the "names" of close allies. But there is little footage of wild killer whales—which hunt and play in open water. Although the whales only swim at about 6 kilometers per hour, it's hard to fully observe them from boats, and they might not act naturally near humans, Zamorano-Abramson says.

That's where drone technology came swooping in. Michael Weiss, a behavioral ecologist at the Center for Whale Research in Friday Harbor, Washington, teamed up with colleagues to launch unmanned drones from their 6.5-meter motorboat and from the shores of the northern Pacific Ocean, flying them 30 to 120 meters above a pod of 22 southern resident killer whales. That was high enough to respect federal aviation requirements—and not bother the whales. They logged 10 hours of footage over a 10-day period, marking the first time drones have been used to study friendly physical contacts in any cetacean.

"These new images show lots of touching of many different types, probably related to different kinds of emotions, much like the complex social dynamics we see in great apes."

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To their surprise, the researchers recorded more than 800 instances of physical contact between individuals, they report this week in the Proceedings of the Royal Society B. Those included slippery hugs, back-to-back and nose-to-nose rubs, and "flipper slaps" between pairs of whales, all dispersed around bouts of leaping out of the water in perfect synchrony. Other whales playfully tossed calves into the air, letting them splash back into the water next to them.

Those interactions weren't just random, Weiss says. The drone images revealed clear preferences among individuals, usually for one "best friend" of the same sex and age. Take J49 and J51—two distantly related young males ages 9 and 6—for instance. "Every time you see a group of whales, those two are right there interacting with each other," Weiss says. "I wouldn't hesitate to use the word friendship here."

These rates of social interaction paralleled those seen in humans and nonhuman primates. "They're making friends and reinforcing that bond with all this physical contact," Weiss says. "We suspected killer whales were supertactile, but even we were surprised with how tactile they [actually] are." The researchers also noted more than 1600 instances of synchronized jumping and breathing, behaviors that imply social cooperation, he adds.

The youngsters led most of these interactions, rather than older females or males. That runs contrary to a body of evidence showing older females' central role in pods. Older males in particular were more "peripheral," Weiss says. "The young individuals really seem to be the glue holding the groups together."

This gradual loss of "centrality" as individuals age is known in many social mammals, including humans, and suggests a "kind of decline in sociality," Weiss says. "One hypothesis is that as animals senesce, they are less able to engage in social interactions."

That finding is "especially intriguing" for biological anthropologist Stacey Tecot at the University of Arizona, who wasn't involved in the study. Scientists have long observed this "social aging" trend in primates, but "there are still a lot of unanswered questions," she says. She hopes for more footage of the whales to learn more.

And that's certainly on the researchers' radar. "We're already gathering new data, with more advanced equipment," says Weiss, speaking from San Juan Island's Snug Harbor, where his team just moored its boat for the night.

"This study is just one piece of a much bigger movement to study different aspects of behavior in marine mammals."

sciencemag.org, 17 June 2021

https://www.sciencemag.org

Freeing oysters from a parasite's hold

2021-06-15

The dead oyster falls from the plastic mesh bag with the hollow clop of a horse hoof on pavement. Its shell gapes, innards rotted. About 100 or more oysters—some living, some dead—quickly follow, clattering like maracas onto the flattened bow of Joe Googoo's dark-green jon boat. Clad in a jacket with blaze-orange sleeves and a ball cap with a moose on it, Googoo pulls a knife from his belt holster in one smooth motion and taps oyster shells with its curved tip as he sorts through the mottled pile. Counting them one by one, he tosses lifeless shells aside and puts the living oysters back in the bag.

Beside Googoo, Robin Stuart, a large, curly-haired man in a tattered black-and-blue drysuit, perches on the boat's edge. Stuart, one of Nova Scotia's most experienced aquaculture experts, cracks jokes as he, too, picks around for "morts"—mortalities. "If you could grow an oyster big enough, Joe would be buried in it," he says with a chuckle. As the longtime friends tally the dead, Stuart soon grows somber. "There's almost as many morts as there are live," he says in his gravelly Scottish-Welsh brogue. "MSX is definitely doing its thing here."

Bras d'Or Lake, cupped within Nova Scotia's Cape Breton Island, is actually a sprawling, semi-enclosed tidal network of bays, estuaries, and ponds scraped out by glaciers at the end of the last ice age. On its muddy bottom, Crassostrea virginica oysters once grew as big as brunch plates, with frilly shells and deep, round cups: qualities prized by oyster connoisseurs. For decades, the Bras d'Or oyster industry blended wild-caught harvest and aquaculture; locals picked oysters from public beds while commercial growers cultivated the shellfish in vast beds on the lake's bottom and transferred them onto floating rafts to await packing and shipping.

Many harvesting families, including Googoo's, are Mi'kmaq, and have lived near the Bras d'Or—which they call Pitu'paq, or "to which all things flow"—for thousands of years. While never a staple, oysters are a fundamental part of Mi'kmaw food traditions and philosophy, with many families harvesting

Counting them one by one, he tosses lifeless shells aside and puts the living oysters back in the bag.

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them year-round for personal consumption. So when the commercial oyster industry took off in the 1950s, many were well positioned to sell oysters for a living. At the industry's peak, estimates Stuart, more than 100 Cape Breton license holders—commercial and recreational, Mi'kmaq and non-Indigenous—had millions of oysters on their farms, collectively worth millions of dollars. Then it fell apart.

In the summer of 2002, a mysterious and deadly invasive parasite called multinucleated sphere unknown, or MSX, flattened Cape Breton's oyster industry. Within months, millions of oysters died, their internal organs devoured by the parasite. Mortality of infected oysters hovered around 90 percent. Nearly all of Googoo's 400,000 oysters died.

"It was devastating," says Anita Basque, who at the time was fisheries manager for Potlotek, a Mi'kmaw community on the Bras d'Or's south shore. Like many others, she grew up picking oysters as a little girl and bringing them home to her mother for a quick snack. She also helped Googoo's father sell shucked oysters, packaged in glass jars, at the Googoo family's roadside shop. Later, as a single mother, she supported her three children with money she made diving for and selling oysters, before she became a bank teller.

When Basque eventually took over as her band's fisheries manager, she met Stuart, who was already well respected in Nova Scotia's aquaculture scene and helped secure oyster leases for the band. A new oyster processing facility Basque initiated launched in 2002 with a grand celebration; within months, the industry collapsed due to MSX. "I was so broken up," says Basque. "My hopes and dreams for the whole community were squashed."

Cape Breton oysters are no longer sold commercially, and the industry has been essentially dead for nearly two decades. Googoo and Basque, who both once held profitable leases, say their kids and grandkids have a hard time understanding their nostalgia. Now, in a last-gasp effort to revive commercial oyster growing in the Bras d'Or, a makeshift team of scientists, community members, and oyster harvesters is fighting to understand and evade MSX. Coordinated by Cape Breton University assistant professor Rod Beresford, theirs is a supergroup of sorts, relying on high-tech devices, traditional knowledge, and elbow grease. It's a collaboration Basque calls "true reconciliation." And what they've found so far could bring the Bras d'Or oyster industry back from the dead.

On the group's second day of fall sampling, Beresford joins Stuart, who is paid for his on-site work, and his lab technician Sindy Dove at a chilly

beach on the north side of the Bras d'Or, far across the lake from Googoo's leases. Beresford avoids getting in the water if he can, so watches the two others scramble along the beach toward a buoy marking the site's four cages: two floating near the top, two resting on the murky bottom.

Beresford, who is also a researcher with Cape Breton's Verschuren Centre for Sustainability in Energy and the Environment, marvels at what brought him to this moment: from studying a creature he doesn't like to eat to buying a black tie emblazoned with Save the Oysters for his PhD defense. Watching Stuart wiggle into his drysuit from afar, he confides that he's never been particularly interested in oysters. But he is interested in solving scientific mysteries.

For decades, the origin and behavior of MSX has been a "real head-scratcher," says Beresford, although some scientists believe that the parasite first hitched a ride to North America in the ballast water of US warships returning from Japan and Korea after the Second World War. Scientists first identified MSX in Delaware Bay, south of New Jersey, after it wiped out thousands of oysters there in 1957. Within decades, it spread, infecting oysters from Maine to Florida. On how the parasite made it to Cape Breton, Beresford says there are two theories: it arrived either in ballast water or via an infected oyster introduced from farther south.

Viewed under a microscope, MSX is "almost a perfect circle, like an emoji [face]," he says. When eaten, it's harmless to humans. But once MSX infects an oyster, the parasite quickly starts to consume the creature's soft innards. Once the oyster loses its digestive organs, it essentially starves to death. Because oyster immune systems don't have a "memory," a weakened oyster that survives its first MSX infection is more likely—not less—to die from a subsequent infection.

As Beresford pondered the puzzle of the Bras d'Or oysters, eventually connecting with Indigenous knowledge holders including Googoo and Basque, he formulated his theory: perhaps the lake's muddy substrate—the soft bottom that nurtures those gorgeous shells—is exactly where MSX lurks. And perhaps certain specific salinity levels and temperatures, which vary as wildly as the lake's diverse bays and inlets, either help or hinder the parasite. If he could keep oysters alive just below the lake's surface, he speculated, maybe he could prevent them from catching the parasite in the first place and eventually revive the region's oyster industry.

It was an ambitious proposal predicated on a simple experiment: with Stuart's expertise, and cooperation from leaseholders who had held onto decades-old government plots, Beresford and his team chose a dozen test

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sites across the Bras d'Or. Googoo, who, after MSX hit, had figured out how to grow thousands of oysters in a protected bay for his own consumption, collected spat and 24,000 native oysters for the project. The team packed cages with 500 oysters each, zip-tied temperature and salinity loggers resembling large black glow sticks to each one, and then sank two to the muddy bottom and floated the other two near the surface at each test site. Then they waited.

Stuart's work counting dead oysters and taking samples, on that misty morning with Googoo on the Bras d'Or, will provide the first glimpse of whether or not Beresford's theory holds. At two of the sites, oyster mortality at the bottom hovers between 40 and 60 percent. Yet only a few dozen of the oysters floating near the surface have died. The difference, Googoo says, validates what he's been insisting all along, that oysters can survive in the Bras d'Or in the right locations.

Beyond the promise of reviving a culturally important Mi'kmaw tradition and a critical component of their lake's ecosystem, the project is also an act of amity. Basque later tells me that working with Beresford's team has been refreshingly devoid of the condescension and sidelining she often experiences from non-Indigenous academics and so-called experts.

Standing beside his boat on shore, Googoo, who claims he's too old for politics or bureaucracy, says he feels the same. "They'll listen to me and my ideas," he says, surveying his oyster lease. "I'm the one out in the field [every day], not them." He taps his knife against the shells, listening for the hollow, disheartening clunk of another dead oyster.

Beside Googoo, Dove—Beresford's lab technician—scrubs barnacles and debris off a temperature logger with a toothbrush. Recently, says Stuart, the expensive devices have been disappearing. They may have fallen off, or, as he suspects, been stolen or vandalized by disgruntled non-Indigenous locals or bored teenagers. "We're going to have to put cameras out," he says.

In recent months, Mi'kmaw fishers across Nova Scotia have exercised their legal, federally protected moderate livelihood fishing rights by catching and selling lobster outside of the non-Indigenous commercial season. In late 2020, protests erupted in violence and vandalism along the province's south shore, and Stuart says similarly hard feelings have been felt here.

Frequently, Beresford fields questions about his work from other university researchers, who say they admire the trust and camaraderie he's earned from his Mi'kmaw collaborators. Basque often hears the same thing, but

is baffled why others find the relationship so elusive. "It all comes down to respect," she says.

Although his team is behind on analyzing tissue samples—the testing facilities are currently backed up due to COVID-19—Beresford is optimistic that he's close to pinning down the sweet spot of temperature, salinity, and depth that would protect oysters from MSX. He believes oysters grown near the surface, where temperature and salinity often vary widely, will have the best chance at survival. Other areas hard hit by the parasite, including parts of the United States, could then use the findings to revive their own industries. Most importantly, Beresford says, it means their team is getting closer to helping people like Googoo and Basque realize their long-deferred dream of reviving the Bras d'Or oyster industry—backed by science, and hopefully built to last.

hakaimagazine.com, 15 June 2021

https://www.hakaimagazine.com

Rain in sub-Saharan Africa can mean more butterflies in Europe

2021-06-21

The "butterfly effect" may have it all wrong. Instead of a single insect's wing flap setting off a distant tornado weeks later, rain in sub-Saharan Africa can lead to more wing-flapping butterflies in southern Europe come the next spring, a new study finds.

Orange-hued with black and white wing tips, the painted lady (Vanessa cardui) is one of the planet's most widespread butterflies, living on every continent except Antarctica and South America. Populations reach tens of millions in Europe alone. Like the monarch butterfly, the painted lady undertakes impressive annual migrations; its round-trip journeys of some 12,000 to 14,000 kilometers reach from sub-Saharan Africa to Scandinavia and back again. It is one of the longest known annual insect migrations. But this exodus is erratic, with the number of immigrant insects arriving in Europe sometimes varying 100-fold year over year. The migration "is a wonder of the natural world, but one that has perplexed naturalists for generations," says ecologist Richard Fox of the U.K. nonprofit Butterfly Conservation, who was not involved in the new study.

Adult painted ladies only live about 2 weeks, so the butterflies' migrations are multigenerational affairs. Experts have long suspected variations in

Populations reach tens of millions in Europe alone.

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spring numbers in the Mediterranean occur because conditions farther south have affected the breeding success of an earlier generation.

To see whether that's true, movement ecologist Jason Chapman of the University of Exeter and colleagues collected 21 years' worth of butterfly observations spanning West Africa to Western Europe, along with corresponding data on environmental conditions and satellite measurements of vegetation growth. The researchers found that the butterflies' spring numbers in Europe are heavily influenced by the amount of monsoon rainfall in western sub-Saharan Africa in the previous summer and fall.

More rain there, they found, leads to flooding, which fuels vegetation that emerging larvae feast on in the winter. Wet years appear to have produced European butterfly booms in 2009, 2015, and this year, the team reports today in the Proceedings of the National Academy of Sciences. Spring vegetation levels in northwestern Africa can also affect painted lady numbers; the butterflies make pit stops in the region en route to Europe.

The findings help scientists envision what a changing climate could mean for the insects, says paper author and ecologist Constantí Stefanescu of the Granollers Museum of Natural Sciences. "Changes in [African] climate and precipitation regimes," he says, "may have drastic consequences on the European populations of this butterfly."

The painted lady hasn't revealed all of its secrets, says ecologist Chris Thomas of the University of York. Now that researchers have taken some mystery out of the insects' northward trek, Thomas says, one remaining puzzle is "how on Earth they manage to navigate and survive" their fantastic return journey southward at the end of the summer.

sciencemag.org, 21 June 2021

https://www.sciencemag.org

'Ballooning' spiders leave behind sea of silk after flood in Australia

2021-06-17

Many residents of Victoria, Australia, evacuated their homes to avoid disastrous floods last week — and upon their return, they found the land, trees and road signs coated in thick veils of shimmering spider silk, according to news reports.

As the residents of Gippsland evacuated their homes, local arachnids also fled for higher ground.

Heavy rains and strong winds triggered flash floods in the Australian state last week, leaving tens of thousands of residents without power, The Guardian reported; two people died when their vehicles became inundated by the floodwaters. The Victoria State Emergency Service had issued flood warnings beforehand, specifically urging residents to evacuate from the Traralgon Creek area, located in the rural Gippsland region of Victoria, according to tweets from Darren Chester, the member of Parliament representing Gippsland.

As the residents of Gippsland evacuated their homes, local arachnids also fled for higher ground. Using a behavior called "ballooning," spiders clambered atop vegetation and flung fine silk threads into the wind; as the threads caught air, the spiders got plucked from their perches and lifted to safety, CNN reported.

"When we get these types of very heavy rains and flooding, these animals who spend their lives cryptically on the ground can't live there anymore, and do exactly what we try to do — they move to the higher ground," Dieter Hochuli, an ecologist at the University of Sydney, told CNN affiliate 7News. "This is a surprisingly common phenomenon after floods," he said, adding that sheetweb spiders — a family of arachnids in the genus Stiphidiidae — likely spun the abundance of silk.

When thousands of spiders balloon at the same time, their many silk threads can merge to form a "remarkable carpet of silk, called gossamer, covering shrubs or fields," according to the Australian Museum. Given how much gossamer accumulated in Gippsland, it's possible that millions of spiders took to the air to escape the floods, Ken Walker, a senior insects curator at Museums Victoria, told The Age, a Victoria-based newspaper.

"To me, it's absolutely beautiful. A silken blanket that undulates throughout vegetation," Walker said. "It also shows the literally tens of thousands, if not millions, of spiders at ground level. Without spiders, we'd have plagues of insects," he added.

Local councillor Carolyn Crossley told BBC News that she noticed the "beautiful" sheets of spider silk while assessing flood damage in the area on Monday night (June 14). "The fact that it didn't separate — it was like these spiders had coordinated to make this incredible landscape art installation or something," she said. Crossley had witnessed this ballooning phenomenon before but never to such a dramatic extent, she said.

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The billowing mats of spider silk should disintegrate sometime this week, BBC News reported. Meanwhile, Gippsland continues to recover from the severe flash floods.

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https://www.livescience.com

50 years ago, UFO sightings in the United States went bust

2021-06-21

What happened to UFOs? — Science News, June 26, 1971

Since 1968 the number of UFO sightings has dropped off, along with public interest in them.… [The] scientific debunking of the UFO phenomena and the subsequent, though not necessarily connected, decline in sightings presents an interesting behavioral pattern…. UFO reports usually run in five-year cycles and 1972 should be the start of another cycle.

Update

Reports of unidentified flying objects have had their ups and downs. In 2020, people in the United States made more than 7,200 reports of UFO sightings — about 1,000 more than in 2019 and nearly 4,000 more than in 2018, according to the National UFO Reporting Center in Davenport, Wash. A quarter of last year's reports occurred in March and April, when much of the country was under lockdown due to the pandemic. Many of these UFOs turned out to be drones or satellites (SN: 3/28/20, p. 24). In late April, the Pentagon officially released naval footage of "unidentified aerial phenomena" that had been shared online, which may have primed some people to seek UFOs in their own backyards.

sciencenews.org, 21 June 2021

https://www.sciencenews.org

UFO reports usually run in five-year cycles and 1972 should be the start of another cycle.

Gravitational waves confirm a black hole law predicted by Stephen Hawking

2021-06-14

Despite their mysterious nature, black holes are thought to follow certain simple rules. Now, one of the most famous black hole laws, predicted by physicist Stephen Hawking, has been confirmed with gravitational waves.

According to the black hole area theorem, developed by Hawking in the early 1970s, black holes can't decrease in surface area over time. The area theorem fascinates physicists because it mirrors a well-known physics rule that disorder, or entropy, can't decrease over time. Instead, entropy consistently increases (SN: 7/10/15).

That's "an exciting hint that black hole areas are something fundamental and important," says astrophysicist Will Farr of Stony Brook University in New York and the Flatiron Institute in New York City.

The surface area of a lone black hole won't change — after all, nothing can escape from within. However, if you throw something into a black hole, it will gain more mass, increasing its surface area. But the incoming object could also make the black hole spin, which decreases the surface area. The area law says that the increase in surface area due to additional mass will always outweigh the decrease in surface area due to added spin.

To test this area rule, MIT astrophysicist Maximiliano Isi, Farr and others used ripples in spacetime stirred up by two black holes that spiraled inward and merged into one bigger black hole. A black hole's surface area is defined by its event horizon — the boundary from within which it's impossible to escape. According to the area theorem, the area of the newly formed black hole's event horizon should be at least as big as the areas of the event horizons of the two original black holes combined.

The team analyzed data from the first gravitational waves ever spotted, which were detected by the Advanced Laser Interferometer Gravitational-Wave Observatory, LIGO, in 2015 (SN: 2/11/16). The researchers split the gravitational wave data into two time segments, before and after the merger, and calculated the surface areas of the black holes in each period. The surface area of the newly formed black hole was greater than that of the two initial black holes combined, upholding the area law with a 95 percent confidence level, the team reports in a paper to appear in Physical Review Letters.

"It's the first time that we can put a number on this," Isi says.

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The area theorem is a result of the general theory of relativity, which describes the physics of black holes and gravitational waves. Previous analyses of gravitational waves have agreed with predictions of general relativity, and thus already hinted that the area law can't be wildly off. But the new study "is a more explicit confirmation," of the area law, says physicist Cecilia Chirenti of the University of Maryland in College Park, who was not involved with the research.

So far, general relativity describes black holes well. But scientists don't fully understand what happens where general relativity — which typically applies to large objects like black holes — meets quantum mechanics, which describes small stuff like atoms and subatomic particles. In that quantum realm, strange things can happen.

For example, black holes can release a faint mist of particles called Hawking radiation, another idea developed by Hawking in the 1970s. That effect could allow black holes to shrink, violating the area law, but only over extremely long periods of time, so it wouldn't have affected the relatively quick merger of black holes that LIGO saw.

Physicists are looking for an improved theory that will combine the two disciplines into one new, improved theory of quantum gravity. Any failure of black holes to abide by the rules of general relativity could point physicists in the right direction to find that new theory.

So physicists tend to be grumpy about the enduring success of general relativity, Farr says. "We're like, 'aw, it was right again.'"

ciencenews.org, 14 June 2021

https://www.sciencenews.org

Lights, Camera, Climate

2021-06-19

In the spring of 2002, multiple movie studios were bidding hard over the right to make an action movie with an unusual adversary: climate change. For Fox, which snagged the deal, the haggling was worth it—when the film was released two years later, The Day After Tomorrow took in more than $550 million in worldwide box office sales, roughly four times its budget.

And yet.

"A movie like The Day After Tomorrow would probably not be made today," says Roland Emmerich, the director and cowriter of the film.

"A movie like The Day After Tomorrow would probably not be made today," says Roland Emmerich, the director and cowriter of the film. Emmerich's name may be unfamiliar, but not the many blockbusters he has cowritten and directed, including Stargate, Godzilla, and Independence Day.

Emmerich has a point. Film and television never quite picked up on global warming's star turn as the bad guy in The Day After Tomorrow. When it comes to popular TV and film, climate change is still riding the bench even as it shows up elsewhere: in music, dance, theater, cli-fi fiction, and even a subgenre called solarpunk.

So why, even as climate change has worsened, displacing millions of people worldwide and costing hundreds of billions of dollars in damage, is it still missing from our screens? Hollywood producers love to turn disaster into entertainment. Why not climate disaster?

When climate change does appear in big-budget productions, its effects are subtle. Think Blade Runner, Mad Max: Fury Road, Interstellar, The Road, and Elysium. In those movies, climate change is like a secret menu at a fast-food restaurant. If you know, you know, but you can enjoy the movie without connecting it to what's happening in our world.

The problem is, film and television don't only reflect culture; they also shape it.

The Day After Tomorrow both entertained and shifted perceptions. A 2004 study, completed after the movie's release and published in the journal Environment: Science and Policy for Sustainable Development, found that people who watched the film became more engaged in the issue of climate change and more concerned about it. The film made them more aware of the effects of climate change, from severe storms to food insecurity to declining living standards. People who had seen the film were more likely to say that their next car would be fuel-efficient and that they felt comfortable talking with friends and family about climate change.

"I would argue that the film had a bigger impact on American public opinion than [Al Gore's] An Inconvenient Truth in terms of just pure numbers," says Anthony Leiserowitz, now the director of the Yale Program on Climate Change Communication, who conducted the study. "The people who saw the film did get engaged, and they actually did learn some important new ideas."

But that consciousness-raising came with a price: a certain scientific inaccuracy. The film's central disaster—a rapid weather shift that envelops

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half the world in ice—bears only a passing resemblance to our warming world. In The Day After Tomorrow, the Atlantic Meridional Overturning Circulation, a conveyor-like ocean current that brings warm water from the equatorial regions to Europe and the North Atlantic, stops. When it does so, it almost immediately ushers in a new ice age from which the characters must escape. It is true that the circulation is slowing down, that it is likely caused by climate change, and that its arrest could lead to more extreme-weather events. But scientists estimate that the shift would take close to 400 years.

Still, when it comes to the implications of climate change, such as climate migration, the film was on solid ground. The Day After Tomorrow includes a scene in which Americans flee the ice by crossing the Rio Grande into Mexico. When producers prescreened it, Emmerich recalls, the migration scene was polarizing. "The liberals liked it a lot, but the conservatives hated it."

The film also foreshadows something that is now commonly recognized in our culture and even has its own idiom: climate grief. In one scene, a teenager named Laura Chapman, played by Emmy Rossum, is waiting out a storm in the remains of the New York Public Library, where she and a motley cast of other New Yorkers have huddled together, burning books for warmth. Surveying the scene, she tells a classmate, "Everything I have ever cared about, everything I've worked for, it's all been in preparation for a future that no longer exists."

Chapman's words practically predicted the testimony of Jamie Margolin in 2019 at the congressional hearing on the global youth climate movement: "Everyone who will walk up to me after this testimony saying I have such a bright future ahead of me will be lying to my face."

It's unclear whether Margolin ever saw The Day After Tomorrow (over email, Margolin's father said that he was almost certain she had never seen the movie). But the parallels speak to the power of fiction: It can help us see things before they arrive.

So why, even as climate change has worsened, displacing millions of people worldwide and costing hundreds of billions of dollars in damage, is it still missing from our screens? Hollywood producers love to turn disaster into entertainment. Why not climate disaster?

Emmerich doesn't have a single definitive answer, but he does have some theories. Climate change is relatively slow-moving, and Hollywood blockbusters tend to rely on action, a fact that Emmerich circumvented in

part by playing loose with the science. Emmerich admits that he cribbed heavily from the structure of Independence Day to craft an entertaining film about the climate emergency. Both movies have an ensemble cast, glimpses of how the disaster is playing out in other regions of the world, characters trying to reunite with loved ones, and even a scene where a dog is briefly placed in peril by the disaster.

"I always said I had to trick Hollywood to get the movie made," Emmerich says, adding that perhaps climate change, with its slowly unfurling time span, might find its niche in television, over multiple episodes.

At least one television show has proved that to be the case. The Amazon series The Expanse successfully merges the science of climate change with stunningly visual storytelling. The show is an epic space drama set several hundred years in the future. Humans have colonized the moon and Mars as well as the asteroid belt and are under the rule of a unified Earth government run by the United Nations.

The Expanse's opening credits chronicle the time shift through the lens of a warming climate. The ice caps melt, the oceans rise, and the Statue of Liberty is submerged before reappearing surrounded by seawalls. In the future of The Expanse, New York City endures, but the Hamptons are an island. So is Anchorage, part of the Yukon archipelago. In Copenhagen, a seawall has been erected around the old city; the rest is underwater. The scenarios are so carefully plotted, there are entire Reddit threads devoted to sussing out all the impacts of climate change in the show.

"I love hearing that," says Naren Shankar, The Expanse's co-showrunner. Before becoming a screenwriter, Shankar earned a doctorate in applied physics and electrical engineering. "It's nice, in a show like this, to put those ideas out there and to deal with these subjects in this unique, dramatic fashion. I love the connection between science and media."

What's the secret sauce for dramatizing global warming on-screen? According to Shankar, simply the willingness to reflect it.

"People ask me about the realistic depictions of space and gravity [on the show], and our response is, we always try to make space a character—the hostility, the environment—obeying the real physics, because that gives you interesting, dramatic visual possibilities that you typically don't see," he says. "We can say much the same thing about climate change. It's so much easier to go into that utopian-dystopian vision where the world is apocalyptic or you solve all the problems."

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Hollywood producers' need to solve all the problems and have a pat ending is reflected in feedback the Fox executives gave Emmerich. The Day After Tomorrow ends with the film's central tension—a father trying to reunite with his son—happily resolved. They are airlifted to safety. But the studio wanted a happier ending. It wanted Emmerich to reverse climate change.

And that's not so easy to do, on-screen or off.

This article appeared in the Summer quarterly edition with the headline "Lights, Camera, Climate."

sierraclub.org, 19 June 2021

https://www.sierraclub.org

Why one of the brightest stars in the sky mysteriously started to dim

2021-06-21

Astronomers may have solved the mystery of Betelgeuse's bizarre brightness drop.

By February 2020, it had lost about two-thirds of its normal luminosity.

In the fall of 2019, Betelgeuse — one of the brightest and best-known stars in the sky — began dimming dramatically. By February 2020, it had lost about two-thirds of its normal luminosity.

Betelgeuse, which forms the shoulder of the constellation Orion (The Hunter), is a bloated red supergiant, a massive star that will die in a violent supernova explosion in the relatively near future. So some astronomers speculated that this "Great Dimming" might be the beginning of Betelgeuse's death throes, and that the star could soon go boom.

PLAY SOUND

"Our results confirm that the Great Dimming is not an indication of Betelgeuse's imminent explosion as a supernova," Montargès and his colleagues wrote in the new study, which was published online today (June 16) in the journal Nature.

However, "some red supergiants may show little or no sign of their impending core collapse, years to weeks before it happens," they added. "Therefore, although the current mass-loss behavior of Betelgeuse does not appear to forebode its demise, it remains possible that it may explode without warning."

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The new research could have applications beyond merely understanding Betelgeuse, which lies about 720 light-years from Earth (though calculations of its distance vary a bit), astronomer Emily Levesque wrote in an accompanying "News and Views" piece in the same issue of Nature.

"This exquisitely detailed study of Betelgeuse's unexpected behavior lays the groundwork for unravelling the properties of an entire population of stars," wrote Levesque, who's based at the University of Washington. "Next-generation facilities focused on monitoring stellar brightness over time, or on studying the signatures of dust in the infrared spectra of stars, could prove invaluable for expanding the lessons learnt here."

livescience.com, 21 June 2021

https://www.livescience.com

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