Bulletin Board

OCT. 04, 2019

CHEMWATCH

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ASIA PACIFIC

Notice: Addition to Annex III of the Rotterdam Convention - Hexabromocyclododecane (HBCD)

2019-09-26

The flame retardant HBCD, has been added to Annex III of the Rotterdam Convention with effect from 16 September 2019. This means HBCD is subject to prior informed consent (PIC) procedures. In this regard, Australia is obliged to ensure that any Annex III export receives permission in advance from a receiving country that is party to the Convention, and must give permission for any import. If you are considering the import or export of HBCD, you are required to contact NICNAS' compliance area.

The Rotterdam Convention is a multilateral environmental agreement on the import and export of certain hazardous chemicals. Countries make informed decisions to accept the chemicals they are prepared to receive, and exclude those they decide they cannot manage safely. Article 13 of the Rotterdam Convention outlines information that is to accompany any import and export of certain hazardous chemicals; these include:

- The specific Harmonised System customs code (assigned by the World Customs Organisation) for a chemical listed in Annex III of the Rotterdam Convention
- GHS labelling and a current safety data sheet in the official language of the importing country (as far as is practicable).

The flame retardant HBCD, has been added to Annex III of the Rotterdam Convention with effect from 16 September 2019.

The Department of the Environment and Energy is Australia's Designated National Authority and the lead Australian Government agency administering the Rotterdam Convention. NICNAS implements the Rotterdam Convention domestically for chemicals intended for industrial use, in accordance with the Industrial Chemicals (Notification and Assessment) Act 1989 (ICNA Act) and associated regulations (ICNA Regulations).

Rotterdam Convention — industrial chemicals

The chemicals listed in Annex III of the Rotterdam Convention include pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons by two or more Parties and which the Conference of the Parties has decided to subject to the Prior Informed Consent (PIC) procedure. There is a total of 50 chemicals listed in Annex III, 34 pesticides (including 3 severely hazardous pesticide formulations), 16 industrial chemicals, and 1 chemical in both the pesticide

and the industrial chemical categories. The Annex III industrial chemicals subject to Prior Informed Consent are as follows:

Chemical	CAS numbers
Crocidolite asbestos Actinolite asbestos Anthophyllite asbestos Amosite asbestos Tremolite asbestos	12001-28-4 77536-66-4 77536-67-5 12172-73-5 77536-68-6
Commercial octabromodiphenyl ether (including Hexabromodiphenyl ether and Heptabromodiphenyl ether)	36483-60-0, 68928-80-3
Perfluorooctane sulfonic acid, perfluorooctane sulfonates, perfluorooctane sulfonamides and perfluorooctane sulfonyls	1691-99-2, 1763-23-1, 24448-09-7, 251099-16-8, 2795-39-3, 29081-56-9, 29457-72-5, 307-35-7, 31506-32-8, 4151-50-2, 56773-42-3, 70225-14-8
Commercial pentabromodiphenyl ether (including tetrabromodiphenyl ether and pentabromodiphenyl ether)	32534-81-9, 40088-47-9
Hexabromocyclododecane (HBCD)	25637-99-
Polybrominated biphenyls - Hexabromobiphenyl - Octabromobiphenyl - Decabromobiphenyl	36355-01-8 27858-07-7 13654-09-6
Polychlorinated biphenyls	1336-36-3
Polychlorinated terphenyls	61788-33-8
Short chain chlorinated paraffins	85535-84-8
Tetraethyl lead	78-00-2
Tetramethyl lead	75-74-1
Tributyl tin compounds	1461-22-9, 1983-10-4, 2155-70-6, 24124-25-2 4342-36-3, 56-35-9, 85409-17-2
Tris (2,3-dibromopropyl) phosphate	126-72-7

Regulatory obligations for importers and/or exporters

Australia's import decisions for industrial chemicals listed in Annex III reflect the current regulatory status of those chemicals in Australia. Importers and exporters are responsible for remaining informed on the status of Annex III-listed chemicals and their respective import decisions published in the PIC Circular.

Regulatory Update

ICNA Regulation 11C prohibits the introduction or export of certain industrial chemicals subject to the Rotterdam Convention. This means that it is unlawful to introduce or export some Annex III listed industrial chemicals without written approval from the NICNAS Director. Pursuant to section 106(5) of the ICNA Act, it is an offence to import, manufacture or export industrial chemicals in contravention of an international agreement to which Australia is a party. The associated penalty for noncompliance is 300 penalty units.

General inquiries about Convention-listed industrial chemicals should be directed to:

Department of the Environment and Energy

Chemicals Management and Hazardous Waste Section

GPO Box 787

Canberra ACT

Australia 2601

Exporting or importing an Annex III listed chemical

Export—annual authorisation

The following two scenarios will incur a fee of $920 to process an annual authorisation to export certain industrial chemicals under the PIC procedure of the Rotterdam Convention (we call these category A exports):

(1) Exporters seeking an annual authorisation to export Annex III listed industrial chemicals to a country that is a party to the convention and has provided an import response that gives consent for the import to occur, or gives consent for the import to occur subject to specified conditions that can be met; or

(2) Exporters who seeks an annual authorisation to export an Annex III listed industrial chemical to a country that is not a party to the convention.

Export—export notification

Processing export notifications to export certain industrial chemicals under the PIC procedure of the Rotterdam Convention will incur a fee of $1,990, which will apply to the following two scenarios (we call these category B exports):

Regulatory Update

(1) Exporters who seek an export notification to be processed by NICNAS to export an Annex III listed industrial chemical to a country that is a party to the convention, but has not provided an import response to the Rotterdam Convention Secretariat for the subject chemical; or

(2) Exporters who seek an export notification to be processed by NICNAS to export an Annex III listed industrial chemical to a country that is a party to the convention, but has provided an import response to the Rotterdam Convention Secretariat for the subject chemical of 'no consent' or with conditions of use that require negotiation.

Import—annual authorisation

Processing an annual authorisation to introduce certain industrial chemicals under the PIC procedure of the Rotterdam Convention will incur a fee of $1,990—currently this applies to the import or manufacture of tetraethyl lead.

(1) Tetraethyl lead can only be introduced in aviation gasoline (avgas), or for use in the production of avgas;

or

(2) The tetraethyl lead is introduced:

in a leaded fuel or fuel additive; and

by a person in respect of whom an approval granted under subsection 13 (1) of the *Fuel Quality Standards Act 2000* is in force at the time of introduction; and

for the purpose of a supply that is specified in the approval. If you intend to import tetraethyl lead in circumstances other than the above-mentioned scenario you may have regulatory obligations—please contact NICNAS.

Payment instructions

Submission of either an annual authorisation or export notification application will not be processed by NICNAS until accompanied by both the appropriate payment and Payment Options Form. Once an application has been submitted to NICNAS and has been determined to meet the appropriate criteria for vetting, your payment will be processed and will be non-refundable.

Further information is available at: Read more about the decision to list HBCD in Annex III of the Rotterdam Convention

NICNAS, 17 September 2019

http://www.nicnas.gov.au/Publications/Chemical_Gazette

Workplace exposure standards open for public comment – Release 3 - benzoyl peroxide to caprolactam

2019-09-26

Safe Work Australia is evaluating the Workplace exposure standards for airborne contaminants to ensure they are based on the highest quality evidence and supported by a rigorous scientific approach. Release 3: benzoyl peroxide to caprolactam is now open for public comment. Please note that this Release includes chemicals that do not currently have an Australian workplace exposure standard. These are: bisphenol-A, bisphenol-A diglycidyl ether, 1-bromopropane, but-2-yne-1,4-diol, γ-butyrolactone. In particular, Safe Work Australia are seeking comments of a technical nature regarding:

- the toxicological information and data that the value is based upon, and
- the measurement and analysis information provided.

Access Safe Work Australia's consultation platform, Engage to provide your comments on the draft evaluation reports and recommendations for Release 3. Please note some evaluation reports have been deferred to Release 4. Public comment will close on 11 October 2019. The feedback received will be considered when making final recommendations for workplace exposure standards. The draft evaluation reports and recommendations for the remaining chemicals will be released throughout 2019 and 2020.

Safe Work Australia are calling for comments on the recommendations for Release 3: benzoyl peroxide to caprolactam.

Safe Work Australia, 17 September 2019

http://www.safeworkaustralia.gov.au

New Chemical Products—Trebon Insecticide containing etofenprox

2019-09-25

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has published an application for registration of a new product containing a new active constituent. The product is Trebon insecticide.

Regulatory Update

Particulars of The Application

Proposed product name: Trebon insecticide

Applicant Company: SIPCAM Pacific Australia Ltd

Name of active constituent: Etofenprox

Signal heading: Schedule - Appendix B (substances considered not to require control by scheduling)

Summary of proposed use: For the control of Queensland fruit fly and Mediterranean fruit fly on Stone fruit except Cherries.

Pack sizes: 1-1000 L

Witholding period: 3 days

Summary of the APVMA's evaluation of trebon insecticide

The APVMA has evaluated the application and in its assessment in relation to whether the safety criteria have been met in accordance with the definition set out in section 5A of the Agvet Code, and proposes to determine that:

- The APVMA is satisfied that the proposed use of trebon insecticide would not be an undue hazard to the safety of people exposed to it during its handling and use.
- The APVMA has conducted a risk assessment on the product and concluded that it can be used safely.
- The APVMA is satisfied that the proposed use of Trebon insecticide will not be an undue hazard to the safety of people using anything containing its residues.
- The APVMA is satisfied that the proposed use of trebon insecticide containing the active constituent etofenprox is not likely to be harmful to human beings if used according to the product label directions.
- The APVMA is satisfied that the proposed use of the new products trebon insecticide containing the active constituent etofenprox, would not be likely to have an unintended effect that is harmful to animals, plants or things or the environment.

The APVMA has evaluated the application and in its assessment in relation to whether the efficacy criteria have been met in accordance with the definition set out in section 5B of the Agvet Code, and proposes to determine that:

- In relation to its assessment of efficacy under section 14(3)(f), the APVMA is satisfied that data from trials supporting the efficacy of the product adequately demonstrate that if used according to the product label directions, the product is effective for its proposed uses.

The APVMA has evaluated the application and in its assessment in relation to whether the trade criteria have been met in accordance with the definition set out in section 5C of the Agvet Code, and proposes to determine that:

- The APVMA is considering whether the proposed use of trebon insecticide would not adversely affect trade between Australia and places outside Australia.

Further Information

A Public Release Summary (PRS) of the evaluation of this product is available from the APVMA website's 'Public Consultation' page, apvma.gov.au/news-and-publications/public-consultations

Making a Submission

In accordance with section13 of the Agvet Code, the APVMA invites any person to submit a relevant written submission as to whether trebon insecticide should be registered. Submissions should relate only to matters that are required by the APVMA to be taken into consideration in determining whether the safety, efficacy or trade criteria have been met. Submissions should state the grounds on which they are based. Submissions must be received by the APVMA within 28 days of the date of this notice and be directed to the contact listed below. All submissions to the APVMA will be acknowledged in writing via email or by post. Relevant comments will be taken into account by the APVMA in deciding whether the product should be registered and in determining appropriate conditions of registration and product labelling.

APVMA Regulatory Update, 24 September 2019

http://www.apvma.gov.au

The Provisions on the Administration of the Road Transport of Dangerous Goods is expected to be revised this year.

JT/T 617 Revisited After 10 Months: A Cornerstone of China's Regulatory Framework for Road Transport of Dangerous Goods

2019-09-26

During the 18th China International Chemical Industry Fair (ICIF) held in Shanghai recently, Mr. Peng Jianhua from the Ministry of Transport

reviewed the *Regulations Concerning Road Transportation of Dangerous Goods* JT/T 617 series; as well as the effects of its implementation at a concurrent session of the event. Mr. Peng noted that the JT/T 617 series has demonstrated some remarkable advantages over previous regulations or standards in this regard. For instance, it explicitly specifies the responsibilities of different parties (like those of shippers, carriers, packers, etc.) in the road transport of dangerous goods, adopts a refined categorization system for dangerous goods, and provides more stringent requirements for risk control, packaging, transport documents, vehicle selection and so forth. It has been proved in practice that, with such arrangements in place, the JT/T 617 series can ensure the smooth implementation of the regulatory framework and enable safer and more convenient road transport of dangerous goods. Besides its impacts on manufacturers and transport businesses, the JT/T 617 series is also affecting the institutional work of relevant regulatory authorities and industry associations. According to Mr. Peng, after JT/T 617 regulations were unveiled in November 2018, several official documents have been devised or revised using the series as a reference, including the *Measures for Safety Administration of Road Transport of Dangerous Goods* which is expected to be officially published soon. Meanwhile, under the framework of JT/T 617 regulations, the *Provisions on the Administration of the Road Transport of Dangerous Goods* will be revised this year as well. Mr. Peng underlined the role of JT/T 617 regulations as a cornerstone in the overarching system governing road transport of dangerous goods in China, suggesting that enterprises should enhance their understanding of the series and stay tuned for any regulatory update so as to ensure their regulatory compliance. Further information is available at:

- ChemLinked translation of JT/T 617.1
- ChemLinked translation of JT/T 617.5
- ChemLinked translation of JT/T 617.6
- ChemLinked translation of JT/T 617.7
- ChemLinked translation of *Provisions on the Administration of the Road Transport of Dangerous Goods*

Chemlinked, 20 September 2019

http://chemlinked.com/en/news

Regulatory Update

AMERICA

U.S. EPA requires eight California facilities to improve chemical safety

2019-09-26

Recently, the United States Environmental Protection Agency (EPA) announced settlements with eight industrial facilities in California over violations of the federal Clean Air Act's chemical safety requirements. The agreements were reached under EPA's expedited settlements policy, which is only used in certain circumstances to address minor, easily correctable violations. The companies have corrected the violations and paid fines totalling $18,780. "Ensuring facilities maintain an updated Risk Management Plan is critical," said EPA Pacific Southwest Regional Administrator Mike Stoker. "These actions ensure that facilities handling dangerous materials are minimising potential impacts to the environment and the surrounding community." EPA inspections found the eight companies violated the Clean Air Act's Chemical Accident Prevention regulations by failing to review and update facility Risk Management Plans; failing to design and maintain safe facilities; failing to conduct periodic compliance self-audits; failing to use updated population data in consequence analysis; or failing to post information on hazardous substances for employees. The companies perform a variety of industrial operations throughout the state. The companies and penalties are:

- Foster Farms Belgravia Plant in Fresno, $6,600
- The Wine Group in Ripon, $2,400
- Ratto Bros. Inc. in Salida, $600
- 6th Street Cooling in Holtville, $1,620
- JR Simplot Company's Helm Plant in Helm, $1,800
- California Dairies Inc. in Fresno, $3,600
- California Resource Production Corp., Grubb Lease Gas Plant in Ventura, $1,600
- Compton Ag Services LLC in Blythe, $2,000

The Clean Air Act's General Duty Clause requires owners and operators of certain industrial sites to design and maintain safe facilities and minimise the consequences of releases. Facilities with significant quantities of toxic substances must develop and implement a Chemical Accident Prevention or Risk Management Program. When properly implemented, risk management plans help prevent chemical releases and minimize

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their potential impacts at facilities that store large amounts of hazardous substances and flammable chemicals. Facilities are required to update and resubmit their risk management plans at least once every five years. The plans are used by EPA to assess chemical risks to surrounding communities and to prepare for emergency responses. To find information on the Clean Air Act's General Duty Clause, visit: https://www.epa.gov/rmp/general-duty-clause-under-clean-air-act-section-112r1

To find additional information on the expedited settlements policy for violations of the Chemical Accident Prevention Provisions of the Clean Air Act, visit: https://www.epa.gov/enforcement/memorandum-use-expedited-settlements-addressing-violations-clean-air-act-caa-chemical

U.S EPA, 27 September 2019

http://www.epa.gov

EPA Takes Action to Ensure California Meets Nation's Air Quality Standards

2019-09-26

The United States Environmental Protection Agency (EPA) Administrator Andrew Wheeler sent a letter to California Air Resource Board (CARB) Chairman Mary Nichols notifying her of the Trump Administration's forthcoming action to eliminate its backlog of California State Implementation Plans (SIPs). This action is a necessary step toward ensuring compliance with EPA's National Ambient Air Quality Standards (NAAQS) designed to ensure that all Americans have clean air. "California has failed to carry out its most basic responsibilities under the Clean Air Act, and as a result, millions of Californians live in areas that do not meet our nation's air quality standards," said EPA Administrator Andrew Wheeler. "EPA stands ready to work with California to meet the Trump Administration's goal of clean, healthy air for all Americans, and we hope the state will work with us in good faith." The state of California represents a disproportionate share of the national list of backlogged SIPs, including roughly one-third of EPA's overall SIP backlog. As most of these California SIPs are inactive and do not meet the minimum threshold of public health protection necessary for approval, they must either be redone or withdrawn. As a first step, EPA is calling on California to immediately withdraw inactive SIPs that would most likely be denied. If California does not withdraw the inactive SIPs in a timely manner, EPA will begin the process of evaluating these SIPs for disapproval and developing Federal

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Implementation Plans that are approvable and will protect public health. Disapproval of a SIP triggers statutory clocks for:

- Highway funding sanctions, which could result in a prohibition on federal transportation projects and grants in certain parts of California.
- New Source Review permitting sanctions.
- A deadline for the issuance of a Federal Implementation Plan (FIP).

"We certainly want to avoid these statutory triggers, but our foremost concern must be ensuring clean air for all Americans. That is our goal," added Wheeler. EPA has made reviewing and approving or disapproving of SIPs a priority to meet its goal of providing regulatory certainty with regard to Clean Air Act implementation. This is particularly relevant for SIPs, which provide important air quality benefits to impacted communities. California's extensive backlog is due to approvability issues, state-requested holds, missing information, or resources. California has the worst air quality in the United States, with 82 nonattainment areas and 34 million people living in areas that do not meet NAAQS—more than twice as many people as any other state in the country.

Background

A SIP is a collection of regulations and documents used by a state, territory or local air district to reduce air pollution in areas that do not meet NAAQS. EPA has established the NAAQS for six criteria air pollutants known to be harmful to human health: carbon monoxide, lead, nitrogen oxide, ozone, particulate matter, and sulfur dioxide. SIPs provide a plan for implementation, maintenance and enforcement of the NAAQS in each state. To learn more, visit https://www.epa.gov/sips/basic-information-air-quality-sips#what-is-a-sip.

U.S EPA, 24 September 2019

http://www.epa.gov

Agency claims other required tests are sufficient to evaluate avian risks

US EPA proposes to waive pesticide toxicity test on birds

2019-09-26

Pesticide manufacturers will no longer have to conduct a test in which chemicals are fed to waterfowl or upland game birds for 5 days to determine whether the substances are toxic to them, under a proposal announced by the US Environmental Protection Agency on 17 September 2019. The agency claims that the test is unnecessary because another

test, in which a single dose of a pesticide is given to a song bird and either an upland game bird or a waterfowl, is sufficient to evaluate risks of the pesticide to birds. Waterfowl include species such as mallard ducks. Upland game birds include northern bobwhite quail. The EPA based its decision on a review conducted in collaboration with the animal rights group People for the Ethical Treatment of Animals (PETA). The reviewers examined 119 pesticides that entered the US market between 1998 and 2017. They found no risks determined using the 5-day test that were not determined using the single-dose test (*Regul. Toxicol. Pharmacol.* 2019, DOI: 10.1016/j.yrtph.2019.03.013). Waiving the 5-day test on birds "will save time, taxpayer money, and hundreds of birds each year without compromising environmental health," Amy Clippinger, president of the PETA International Science Consortium, which advocates for nonanimal testing, says in a statement. The EPA's announcement comes 1 week after the agency announced its intent to eliminate the use of animals in toxicity testing by 2035. The EPA is accepting comments on the pesticide proposal until Nov. 1.

Chemical & Engineering News, 19 September 2019

http://pubs.acs.org/cen/news

Latest Version of TSCA Inventory Includes Unique Identifier Information

2019-09-24

The U.S. Environmental Protection Agency (EPA) announced on September 19, 2019, that it posted the first public Toxic Substances Control Act (TSCA) Inventory to include unique identifier (UID) information. EPA states that the UID is a numerical identifier assigned to a chemical substance when EPA approves a confidential business information (CBI) claim for specific chemical identity. When EPA approves such a claim, it assigns a UID to that chemical identity; applies the UID to other information or submissions concerning the same substance; and ensures that any non-confidential information received by EPA identifies the chemical substance using the UID while the specific chemical identity of the chemical substance is protected from disclosure.

EPA notes that this is the first time that the public version of the TSCA Inventory includes both a field containing a UID for those chemical substances with approved confidentiality claims for specific chemical identity and a field containing the ten-year expiration date from the assertion of such approved claims. EPA states that the UIDs provide the

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public with a way to connect the specific chemical identity previously listed on the confidential portion of the TSCA Inventory with other relevant information in EPA's holdings.

Commentary

EPA's goal is to publish an up-to-date version of the TSCA Inventory about every six months. With the version published on September 19, 2019, EPA has taken another positive step in implementing its obligations under TSCA. The Inventory now includes two new fields: UI (for the unique identifier or UID) and EX (indicating the expiration date of the CBI claim). EPA continues to work through CBI identities, so only a few of the CBI substances have a UID. We expect that EPA will begin to assign UIDs to CBI substances that are newly added to the Inventory (*e.g.*, through a Notice of Commencement submitted going forward). We also expect that EPA will assign UIDs to substances that were claimed as CBI on a Form A as EPA works through reviewing the almost 8,000 substances listed as active on the confidential portion of the Inventory. A more detailed commentary is available in our September 20, 2019, memorandum, "EPA Includes Unique Identifier Information on Updated TSCA Inventory."

National Law, 24 September 2019

EUROPE

Public consultation: cumulative risk assessment of pesticides

2019-09-26

The European Food Safety Authority (EFSA) is carrying out a public consultation on its pilot assessments of the risks posed to humans by residues of multiple pesticides in food.

The European Food Safety Authority (EFSA) is carrying out a public consultation on its pilot assessments of the risks posed to humans by residues of multiple pesticides in food. Interested parties have until 15 November to submit comments on two assessments: one considers chronic effects on the thyroid system and the other looks at acute effects on the nervous system. The draft assessments are the culmination of a multi-year collaboration between EFSA and the National Institute for Public Health and the Environment for the Netherlands (RIVM). The overall draft conclusion for both assessments is that consumer risk from dietary cumulative exposure is below the threshold that triggers regulatory action for all the population groups covered. To assist stakeholders who wish to contribute to the consultation, EFSA is holding a special meeting in Brussels at which EFSA scientists and external experts will present

and discuss the main elements and findings of the pilot assessments. Registration for the event is now open.

Background

The substances considered in the assessments were identified by EFSA's pesticide experts using a methodology specially devised for classifying pesticides into "cumulative assessment groups" (CAGs). The methodology rests on the assumption that pesticides causing the same specific effects can produce cumulative toxicity. The EU regulation on maximum levels of pesticides in food (MRLs) stipulates that decisions on MRLs should take into account cumulative effects of pesticides as and when the methods to assess such effects become available. In addition, the regulation covering the placing of pesticides on the market stipulates that pesticides should have no harmful effects – including cumulative effects – on humans. For further information, see our FAQ.

EFSA, 17 September 2019

http://www.efsa.europa.eu

Study finds EU regulatory framework ready for the next generation of nanomaterials

2019-09-26

A study commissioned by the EU nanomaterials observatory has found that the current EU regulatory framework for characterising and identifying "next generation" nanomaterials is able to address the majority of them and that no significant changes will be needed in the near future. The study looked into "next generation" nanomaterials and whether the current terminology used in the EU chemicals regulations, as well as the implementation of the current legal requirements for identifying nanomaterials, are likely to pose technical challenges for these "next generation" materials. The findings indicate that although the regulatory framework is well-equipped to handle these materials in the near future, further guidance would benefit companies registering nanomaterials under the REACH Regulation. The study goes on to propose further clarifications for some parameters characterising both nanomaterials and their uses and that the guidelines on how to determine whether an object is an article under the REACH Regulation could be complemented with specific examples of different nanomaterials, from simple nanoparticles to more complex assembly structures. ECHA is updating its guidance on the identification of nanomaterials following the changes in the REACH

A study commissioned by the EU nanomaterials observatory has found that the current EU regulatory framework for characterising and identifying "next generation" nanomaterials is able to address the majority of them and that no significant changes will be needed in the near future.

annexes. The updated guidance is expected to be published later this year. The study was commissioned by the European Union Observatory for Nanomaterials (EUON) and was carried out by Risk & Policy Analysis Limited (RPA).

Background

Member States voted to revise the REACH annexes to include specific information requirements for nanomaterials manufactured or imported on the EU market in quantities above one tonne. The new requirements apply from 1 January 2020 and will enable companies and authorities to systematically assess the hazardous properties of nanomaterials, how they are used safely, and what risks they may pose to our health and the environment. This information will help authorities in the EU to identify if further risk management measures are needed. The EUON aims to increase the transparency of information available to the public on the safety and markets of nanomaterials in the EU. A key aim of the observatory is to create a one-stop shop for information, where EU citizens and stakeholders including NGOs, industry, and regulators can all easily find accessible and relevant safety information on nanomaterials on the EU market. Further information:

- A state of play study of the market for so called "next generation" nanomaterials
- Background note: what are next generation nanomaterials and why are they being looked into?
- EUON: Companies to provide more information on nanomaterials

European Union Observatory for Nanomaterials, 19 September 2019

https://euon.echa.europa.eu/view-article/-/journal_content/title/study-finds-eu-regulatory-framework-ready-for-the-next-generation-of-nanomaterials

French parliament to mull law to cut consumer waste

2019-09-26

From 25 September 2019, France's parliament will debate legislation seeking to move the country closer to its ambition of a low-waste future, forcing electronics firms to use second-hand materials and cutting down on plastic refuse. France, with its population of nearly 70 million, is a voracious consumer of natural resources, producing five tonnes of waste per person per year, according to the environment ministry. The French Senate will begin three days of discussion on the bill before it is handed

From 25 September 2019, France's parliament will debate legislation seeking to move the country closer to its ambition of a low-waste future, forcing electronics firms to use second-hand materials and cutting down on plastic refuse.

to the lower house of parliament, the National Assembly, where President Emmanuel Macron's government has a large majority. The legislation would compel computer and cellphone repair shops to use second-hand materials, and oblige industries — including manufacturers of toys, building materials, cigarettes and cleaning products — to manage the waste these products generate as well as their packaging.

'Long way to go'

The law would also compel manufacturers to provide consumers, beginning in 2021, with information on how their newly-purchased product can be repaired. In a report last year titled "Roadmap for the Circular Economy", the French government outlined plans to halve the amount of non-hazardous waste sent to landfills by 2025. "The situation is clear: France has a long way to go… In 2014, the rate of recovery of household and similar waste was 39% — much lower than our German (65%) or Belgian (50%) neighbours," the report said. "The rest, half of which is organic waste, is therefore incinerated or landfilled, which leads to local environmental pollution and energy waste that is incompatible with our climate objectives" of reducing greenhouse gas emissions from burning oil and coal. Only about a fifth of plastic was recycled, said the report — lower than the European Union average of 30% or Scandinavian countries with more than 90%. The French use about 47,000 tonnes of discardable cleaning wipes every year, and destroy some €650 million worth of unsold, non-food products.

'Repair, reuse'

The government has pitched the bill as crucial to the drive to create a so-called "circular economy" in which used products are fixed, reused, or recycled. But not all are convinced. "Sure, there are positive measures… but nothing to address the upstream, to avoid the generation of waste nor the overuse of packaging," said centrist senator Hervé Maurey. The research foundation Tara Ocean, in an open letter signed by numerous scientists, said the only way to turn the tide on plastic was to introduce a bottle return scheme. Green parties surged across Europe in European elections in June, not least in France where the EELV party came third with 13.5% of the vote. In January, France's junior environment minister Brune Poirson promised a law to tackle waste after a television documentary showed Amazon destroying millions of products that had been returned by consumers. British fashion firm Burberry also caused a furore last year by acknowledging it had burned unsold clothes, accessories and perfume worth £28.6 million (€23 million) annually to prevent them being sold off

Regulatory Update

cheaply. Macron has sought to portray himself as a friend of the Green movement, especially in the fight against climate change. But his image was tarnished when prominent campaigner Nicolas Hulot, who Macron named as environment minister, spectacularly quit the government last August, saying his cabinet colleagues were doing too little to tackle climate change. The world produces more than 300 million tonnes of plastics annually, and there are at least five trillion plastic pieces floating in our oceans, scientists say. Some 40 million tonnes of electronic waste are produced every year.

Euractiv, 24 September 2019

http://www.euractiv.com/

REACH Update

ECHA's committees conclude on two restrictions and 15 harmonised classification and labelling opinions

2019-09-27

The Committee for Socio-economic Analysis (SEAC) adopted its opinion on granules and mulches used as infill material in synthetic turf pitches or in loose forms on playgrounds. The Committee for Risk Assessment (RAC) adopted its opinion on the restriction proposal on N,N-dimethylformamide (DMF). SEAC adopted its final opinion on the restriction proposal by the Netherlands to not place the granules and mulches in question on the market if the sum of the listed polycyclic aromatic hydrocarbons (PAHs) in the materials is more than 20 mg/kg. RAC and SEAC supported the restriction proposal by Italy to restrict the uses of the N,N-dimethylformamide (DMF) on its own or in mixtures in a concentration equal or greater than 0.3 %. A public consultation on the agreed SEAC opinion will begin soon and the committee is expected to adopt an opinion at its December meeting. RAC has adopted 15 opinions on harmonised classification and labelling, including opinions on 12 active substances used in biocidal products and/or plant protection products and three industrial chemicals. RAC agreed on five draft opinions on authorisation applications for uses of chromium trioxide, coal tar pitch, high temperature and octylphenol ethoxylates. SEAC agreed on 18 draft opinions on uses of chromium (VI) substances, coal tar pitch, high temperature, and octyl- and nonylphenol ethoxylates. Furthermore, RAC and SEAC discussed key issues in 27 applications for authorisation, which were received by ECHA in May 2019. More information about the opinions is available in the annex. Further information is available at:

- Annex to news release
- ECHA's scientific committees support restricting PAHs in granules and mulches

ECHA, 24 September 2019

http://echa.europa.eu

The Committee for Socio-economic Analysis (SEAC) adopted its opinion on granules and mulches used as infill material in synthetic turf pitches or in loose forms on playgrounds.

Public consultation on SEAC's draft opinion on restricting N,N-dimethylformamide

2019-09-27

Stakeholders are invited to comment on the draft opinion of the Committee for Socio-economic Analysis (SEAC) concerning the restriction proposal by Italy on N,N-dimethylformamide (EC 200-679-5, CAS 68-

12-2). The public consultation is open until 25 November 2019. Further information is available at: Submitted restrictions under consideration

ECHA News, 25 September 2019

Public consultation launched on the proposed restriction of calcium cyanamide

2019-09-27

The European Chemicals Agency (ECHA) has submitted a proposal to restrict calcium cyanamide (EC 205-861-8, CAS 156-62-7) as a fertiliser. The consultation is open from 25 September 2019 to 25 March 2020. ECHA's scientific committees welcome early comments by 20 November 2019 to assist them in the first discussion of the proposal. Further information is available at: Submitted restrictions under consideration

ECHA News, 25 September 2019

Committees' opinion on four applications for authorisation available

2019-09-27

The European Chemicals Agency (ECHA) has released the consolidated opinions of the Committees for Risk Assessment and Socio-economic Analysis for six uses of chromium trioxide (EC 215-607-8, CAS 1333-82-0) by Aloys F. Dornbracht GmbH & Co.KG; Schell GmbH & Co. KG Armaturentechnologie; KEUCO GmbH & Co KG; Ideal Standard - Vidima AD and Ideal Standard Produktions-GmbH are available on our ECHA's website. Further information is available at: Opinions

ECHA News, 25 September 2019

http://echa.europa.eu

The European Chemicals Agency (ECHA) has submitted a proposal to restrict calcium cyanamide (EC 205-861-8, CAS 156-62-7) as a fertiliser.

Postponement of compliance deadline for reporting to poison centres

2019-09-27

The CARACAL (expert group on CLP) has agreed unanimously to the European Commission's proposed changes to Annex VIII to CLP. The Commission is now proceeding with adopting a delegated act, which will, among other things, postpone the first compliance date for harmonised reporting to poison centres, for mixtures intended for consumer use, from 1 January 2020 to 1 January 2021. Entry into force is expected later this

year. Other compliance dates will not be affected. The Commission is also progressing with solving some of the concerns raised by stakeholders on the workability of the notification requirements and another amendment to Annex VIII is expected in 2020. Further information is available at: Draft delegated regulation

ECHA News, 25 September 2019

http://echa.europa.eu

Public consultation on harmonised classification and labelling

2019-09-27

The European Chemicals Agency (ECHA) is looking for comments on the harmonised classification and labelling proposals for:

- Cumene (EC 202-704-5, CAS 98-82-8),
- Dibutyltin bis(2-ethylhexanoate) (EC 220-481-2, CAS 2781-10-4; (11111-26-5),
- Dibutyltin di(acetate) (EC 213-928-8, CAS 1067-33-0),
- Divanadium pentaoxide; vanadium pentoxide (EC 215-239-8, CAS 1314-62-1),
- Reaction mass of 3-(difluoromethyl)-1-methyl-N-[(1RS,4SR,9RS)-1,2,3,4-tetrahydro-9-isopropyl-1,4-methanonaphthalen-5-yl]pyrazole-4-carboxamide and 3-(difluoromethyl)-1-methyl-N-[(1RS,4SR,9SR)-1,2,3,4-tetrahydro-9-isopropyl-1,4-methanonaphthalen-5-yl] pyrazole-4-carboxamide; isopyrazam (EC -, CAS 881685-58-1).

The deadline for comments is 22 November 2019. To provide comments, go to: Give comments

ECHA News, 25 September 2019

http://echa.europa.eu

Proposals to harmonise classification and labelling

2019-09-27

The European Chemicals Agency (ECHA) has published a proposal to harmonise classification and labelling that has been submitted for

undecan-2-one; methyl nonyl ketone (EC 203-937-5, CAS 112-12-9). Further information is available at: Registry of CLH intentions

ECHA News, 25 September 2019

http://echa.europa.eu

Court confirms Bisphenol A as an endocrine disrupter to human health

2019-09-27

On 20 September 2019, the General Court issued a judgement in case T-636/17 dismissing in its entirety an action brought against ECHA's decision to include bisphenol A (EC 201-245-8, CAS 80-05-7) in the Candidate List on the basis that it is a substance of a very high concern having endocrine disrupting properties for human health. The Court found that the Applicant failed to demonstrate legal or scientific error by ECHA rendering the identification as unlawful or implausible. Further information on the judgement is available at: Judgement

ECHA News, 25 September 2019

http://echa.europa.eu

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Janet's Corner

Climate Summit

2019-09-21

Hazard Alert

1-Bromopropane

2019-09-15

1-Bromopropane (*n*-propylbromide or nPB) is an organobromine compound with the chemical formula $CH_3CH_2CH_2Br$. [1] It is a colourless liquid. Slightly denser than water and slightly soluble in water. When heated to high temperatures may emit toxic fumes. [2]

USES [3]

1-Bromopropane was originally used in the production of pesticides, flavours and fragrances, pharmaceuticals, and other chemicals.
It is currently used as a solvent in the adhesives, dry cleaning, vapour degreasing, and electronic and metal cleaning industries.
1-Bromopropane production has increased over the last 10 years due to its use as a replacement for other more harmful substances.

SOURCES & ROUTES OF EXPOSURE

1-Bromopropane (n-propylbromide or nPB) is an organobromine compound with the chemical formula CH3CH2CH2Br.

Sources of Exposure [3]

- Exposure to 1-bromopropane is mainly an occupational problem.
- Workers using 1-bromopropane as a spray adhesive have the highest exposures.
- Workers involved in the production of 1-bromopropane or those using it in commercial applications have potential for high exposure.
- You may be exposed to 1-bromopropane in air when it is used during aerosol applications.

Routes of Exposure [4]

- Inhalation – Principal route of exposure for workers using 1-bromopropane in aerosol applications. Potential route of exposure for populations living near industrial facilities where 1-bromopropane is used in aerosol applications.
- Oral – Not an important route of exposure because 1-bromopropane has not been detected in food or water.
- Dermal – Important route of exposure for workers using 1-bromopropane as a spray adhesive.

HEALTH EFFECTS [5]

Acute Effects

Short-term exposure to 1-bromopropane can result in irritation of the eyes, nose, throat or respiratory tract.

Chronic Effects

Chronic (long-term) exposure to 1-bromopropane can adversely affect peripheral nerves and the central nervous system. Symptoms that have been reported include joint pain or leg weakness and pain leading to difficulty standing and walking; muscle twitching or numbness, tingling and prickling in the hands or feet, loss of vibration sense; and anxiety, apathy, insomnia, and difficulties with concentration and memory.

Other health effects that may also occur include dermatitis, nausea and vomiting, diarrhoea, difficulty in swallowing, disruption or failure of menstruation, urinary difficulties, anaemia or low haematocrit (red blood cell count), liver damage, and lung disease.

Reproductive Hazards

Animal studies have shown that inhalation exposure to 1-bromopropane can result in decreased foetal weight and skeletal variations. In addition, similar studies in animals have shown 1-bromopropane to cause decreased fertility, decreased prostate weight and effects on sperm quality. Some case studies of female workers occupationally exposed to 1-bromopropane reported altered menstrual periods.

Carcinogenic Activity

Presently, no epidemiological studies or case reports have been identified that examine the relationship between human cancer and exposure to 1-bromopropane.

SAFETY [6]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.
- Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated

clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Fire & Explosion Information

- 1-bromopropane is flammable;
- Auto-Ignition Temperature: 490°C (914°F)
- Products of Combustion include carbon oxides (CO, CO2).
- 1-bromopropane is flammable in the presence of open flames and sparks.
- Small fires should be extinguished using dry chemical powder.
- Large fires should be extinguished using alcohol foam, water spray or fog.
- Cool containing vessels with water jet in order to prevent pressure build-up, auto-ignition or explosion.
- When heated to decomposition 1-bromopropane emits highly toxic fumes of hydrogen bromide.

Exposure Controls & Personal Protection

Engineering Controls

- Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.

- Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protective Equipment

The following personal protective equipment is recommended when handling 1-bromopropane:

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

Personal Protection in Case of a Large Spill:

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

REGULATION

United States [7]

ACGIH: The American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for 1-bromopropane of 10 ppm, 50 mg/m3 TWA

REFERENCES

1. https://en.wikipedia.org/wiki/1-Bromopropane
2. http://www.chemicalbook.com/ChemicalProductProperty_EN_CB8341613.htm
3. http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=1473&tid=285
4. http://www.atsdr.cdc.gov/toxguides/toxguide-209.pdf
5. http://www.nclabor.com/osha/etta/indguide/ig52.pdf

6. http://www.sciencelab.com/msds.php?msdsId=9923169
7. https://www.osha.gov/dts/chemicalsampling/data/CH_222006.html

Gossip

Discovery of periodic tables for molecules

2019-09-18

The periodic table of elements was proposed in 1869, and thereafter became one of the cornerstones of the natural sciences. This table was designed to contain all the elements (atoms) found in nature in a special layout that groups them in rows and columns according to one of their most important characteristics, the number of electrons. Scientists have used the periodic table for decades to predict the characteristics of the then-unknown elements, which were added to the table over time. Could there be such a periodic table for molecules? Although some researchers have thought about this possibility and proposed periodic rules for predicting the existence of certain molecules, these predictions were valid only for clusters of atoms with a quasi-spherical symmetry, because of the limitations of their own theory. However, there are many clusters of atoms with other shapes and other types of symmetries that should be accounted for with a better model. Thus, a research team from Tokyo Tech, including Dr. Takamasa Tsukamoto, Dr. Naoki Haruta, Prof. Kimihisa Yamamoto and colleagues, proposed a new approach to build a periodic table for molecules with multiple types of symmetries. Their approach is based on a keen observation on the behaviour of the valence electrons of atoms that form molecular clusters. The valence electrons can be regarded as "free" electrons in atoms with an outermost orbital, and thus they can interact with the electrons of other atoms to form compounds. When multiple atoms form a cluster with a symmetrical shape, their valence electrons tend to occupy specific molecular orbitals called as "super-atomic orbitals", in which they behave almost exactly as if they were the electrons of a huge atom. By considering this fact and analysing the effects of the structural symmetries for clusters (Fig. 1), the researchers proposed "symmetry-adapted orbital (SAO) models," which are in agreement with multiple known molecules as well as state-of-the-art quantum-mechanical calculations. The new periodic tables, which would be created for each symmetry type, would actually be four-dimensional, as shown in Fig. 2, because the molecules would be arranged according to four parameters: groups and periods (based on their "valence" electrons, similar to the normal periodic table), species (based on the constituting elements), and families (based on the number of atoms). The SAO approach is very promising in the field of materials design. "Modern synthesis techniques enable us to produce many innovative materials based on the SAO model, such as lightweight magnetic materials," states Prof. Yamamoto. The road ahead for scientists lies in further expanding these tables to molecular clusters with other shapes and symmetries and predicting

Researchers have proposed a new approach to build a periodic table for molecules with multiple types of symmetries.

stable molecules that have yet to be developed. "Among the infinite combinations of constitutive elements, the proposed periodic table will be a significant contribution to the discovery of novel functional materials," concludes Prof. Yamamoto.

EurekAlert, 9 September 2019

http://www.eurekalert.org

Spintronics: Physicists discover new material for highly efficient data processing

2019-09-18

A new material could aid in the development of extremely energy efficient IT applications. The material was discovered by an international research team in cooperation with Martin Luther University Halle-Wittenberg (MLU). The electrons at the oxide interface of the material possess special properties which drastically increase the conversion rate of spin current to charge current. This is the foundation for future spintronic applications. The new material has been found to be more efficient than any previously investigated material, the team writes in the journal Nature Materials. Electric current flows through all technical devices. Heat is generated and energy is lost. Spintronics explores new approaches to solving this issue that utilise a special property of electrons: spin. This is a type of intrinsic angular momentum of electrons that generates a magnetic torque and it is what causes magnetism. The idea behind spintronics is: If spin current flows through a material instead of an electrical charge, no heat is generated and significantly less energy is lost in the device. "However, this approach still requires an electric current for the device to work. Therefore, an efficient spin-to-charge conversion is necessary for this novel technology to work," explains Professor Ingrid Mertig, a physicist at MLU. Her research group is part of the international research team that discovered the new material. The work was led by the French physicist Dr Manuel Bibes, who conducts research at the renowned institute Centre national de la recherche scientifique (CNRS) - Thales. The group investigated the interface between two oxides. "The two substances are actually insulators and are non-conductive. However, a kind of two-dimensional electron gas forms at their interface, which behaves like a metal, conducts current and can convert charge current into spin current with extremely high efficiency," explains Mertig. Dr Annika Johansson and Börge Göbel, two members of her research group, provided the theoretical explanation for this unusual observation. According to the researchers, the new material is significantly more efficient than any other

A new material could aid in the development of extremely energy efficient IT applications.

known material. This could pave the way for the development of new, energy-saving computers. MLU has extensive expertise in the field of oxide interfaces. Since 2008, Collaborative Research Centre 762 "Functionality of Oxidic Interfaces" has been located at MLU, which is funded by the Deutsche Forschungsgemeinschaft (German Research Foundation, DFG). The CRC is part of the university's core research area "Materials Science - Nanostructured Materials". The idea for the project arose during Manuel Bibes's guest stay in Halle last year. Bibes is a recipient of the Alexander von Humboldt Foundation's Friedrich Wilhelm Bessel Research Award. The prize is awarded to internationally renowned scientists from abroad for their research achievements. Researchers can use the prize money for research stays at German universities and research institutions.

EurekAlert, 9 September 2019

http://www.eurekalert.org

Nanoparticles in lithium-sulphur batteries detected with neutron experiment

2019-09-18

The operando cell was developed at HZB and allows to analyse processes inside the battery during charging cycles with neutrons.

Lithium-sulphur batteries are regarded as one of the most promising candidates for the next generation of energy storage devices. They have a theoretical gravimetric energy density that is five times higher than that of the best lithium-ion batteries currently available. And they even work at sub-zero temperatures of down to -50 °C. In addition, sulphur is inexpensive and environmentally friendly. However, their capacity so far has fallen sharply with every charge-discharge cycle, so that such batteries are not yet long-lasting. The loss of capacity is caused by complicated reaction processes at the electrodes inside the battery cell. It is therefore particularly important to understand exactly how the charge (sulphur) and discharge (lithium sulphide) products precipitate and dissolve. While sulphur precipitates macroscopically and therefore lends itself to examination by imaging techniques or X-ray diffraction during cycling, lithium sulphide is difficult to detect due to its sub-10-nm particle size. Insight into this has now been provided for the first time by investigations with the BER II neutron source at the HZB. Dr. Sebastian Risse used a measuring cell he developed to illuminate lithium-sulphur batteries with neutrons during charging and discharging cycles (operando) and simultaneously performed additional measurements with impedance spectroscopy. This enabled him and his team to analyse the dissolution and precipitation of lithium sulphide with extreme precision during ten discharge/charging cycles. Since neutrons interact strongly

with deuterium (heavy hydrogen), the researchers used a deuterated electrolyte in the battery cell to make both the solid products (sulphur and lithium sulphide) visible. Their conclusion: "We observed that the lithium sulphide and sulphur precipitation does not take place inside the microporous carbon electrodes, but instead on the outer surface of the carbon fibres," says Risse. These results provide a valuable guide for the development of better battery electrodes.

Phys.org, 6 September 2019

http://phys.org

Making sustainable polymers from fragrant molecules

2019-09-18

A way of making organic polymers from the fragrant molecules in conifers and fruit trees has been developed by scientists at the University of Birmingham. The technique, developed for 3-D printing applications, could lead to a new generation of sustainable materials for use in biomedical applications or prototyping. Called terpenes, the molecules are found in the essential oils of a wide variety of plants and are often used in fragrances, cosmetics and other household products. Because they are tricky to extract and process, synthetic versions are often substituted. Terpenes can also be used to produce resins. This makes them extremely interesting to chemists and engineers investigating new sustainable polymers to replace plastics made from petrochemicals. The challenge is to find a way of processing the terpenes efficiently enough to produce interesting materials. Researchers in the University of Birmingham's School of Chemistry, have devised a technique for extracting the molecules and converting them into stable resins. By combining them with sulfur-based organic compounds called thiols, the resins can be activated by light to form a solid material. Their results are published in Polymer Chemistry. Processing the terpenes in this way makes them particularly useful in a 3-D printing process called stereolithography, where objects are built up in multiple layers and fused together under UV light to form 3-D objects. Lead author, Professor Andrew Dove, explains: "We need to find sustainable ways of making polymer products that do not rely on petrochemicals. Terpenes have been recognized as having real potential in this search and our work is a promising step towards being able to harness these natural products." Different terpenes produce different material properties and the next step for the team is to investigate those properties more fully to better control them. Although the fragrances are not key to

A way of making organic polymers from the fragrant molecules in conifers and fruit trees has been developed by scientists at the University of Birmingham.

the terpenes' material properties, researchers are interested to see if they can also be harnessed in some products.

Phys.org, 6 September 2019

http://phys.org

Fe metabolic engineering method succeeds in producing 1,2,4-butanetriol sustainably from biomass

2019-09-18

A more environmentally-friendly and sustainable method of producing the useful chemical 1,2,4-butanetriol has been discovered. The Kobe University team were the first in the world to utilize a method involving the direct fermentation of xylose in rice straw using an engineered yeast strain to produce 1,2,4-butanetriol. In the course of conducting this research, the team successfully overcame two bottlenecks to maximize the production. The research was conducted by Academic Researcher Takahiro Bamba and Professor Akihiko Kondo (from the Graduate School of Science, Technology and Innovation), and Professor Tomohisa Hasunuma (of the Engineering Biology Research Centre). 1,2,4-butanetriol uses and current production methods:

A more environmentally-friendly and sustainable method of producing the useful chemical 1,2,4-butanetriol has been discovered.

The commodity chemical 1,2,4-butanetriol has a wide variety of practical uses across different fields. For example, it can be utilised in the production of solvents and to synthesise various pharmaceutical products- such as anti-viral and cholesterol-lowering drugs, among others. Current methods of producing 1,2,4-butanetriol use raw materials derived from oil and result in by-products that are harmful to the environment. The most common way to produce the chemical is by using sodium borohydride ($NaBH_4$) to chemically reduce malic acid to 1,2,4-butanetriol. However, the process generates a large amount of borate salts. Disposing of these salts causes pollution. Chromite and Rubidium can also be used as catalysts for 1,2,4-butanetriol production, however these methods require high temperature and high pressure, and also result in toxic by0products. Deriving xylose (the second most abundant natural sugar) from lignocellulosic biomass (dry plant matter) and using it to produce chemicals offers multiple advantages as it is a renewable resource that causes far less environmental pollution. It provides a sustainable alternative to petroleum-based production.

Methodology:

Gossip

1,2,4-butanetriol is produced by microbes through a 5-stage reaction process within the cells. However, in steps 1, 3 and 4 of the reaction, there were no enzymes to provide a catalyst in the yeast. In this study, rice straw hydrolysate was used to produce xylose. The yeast used was genetically engineered with the required enzymes in order to successfully produce an efficient yield of 1,2,4-butanetriol. In the first successful trial, only 0.02g/L of 1,2,4-butanetriol was produced. By examining these results, it became apparent that there were insufficient catalytic activities for Stage 3 and Stage 4 inside the yeast cells. This meant that the reaction was slowed down in Stages 3 and 4. These reactions were considered to be bottlenecks. With the presence of iron sulphur clusters within the structure of the xylonate dehydratase catalyst in stage 3, it became clear that it was difficult for the yeast to maintain a reaction with the iron sulphur protein in the cells. This was due to an insufficient amount of iron sulphur clusters within the yeast cells. Iron (Fe) is essential for the yeast cells to produce 1,2,4-butanetriol, however too much iron damages the cells. Metabolic engineering (optimising regulatory and genetic processes within cells to increase the production of a particular substance) was utilised to further genetically modify the yeast in order to increase its iron metabolism. This improved the yeast's reactivity with the xylonate dehydratase and ensured that functional Fe-S enzymes were formed. Using this modified yeast strain improved catalytic activity by approximately 6 times. Furthermore, the Stage 4 bottleneck was overcome by using KdcA (derived from Lactococcus lactis- a bacterium commonly used for fermentation in the food industry) as the decarboxylase to provide sufficient catalytic activity.

Results:

Ultimately, this method succeeded in producing 1.7g/L of 1,2,4-butanetriol when engineered yeast was used. In addition, 1.1 g/L of 1,2,4-butanetriol was produced by the rice straw hydrolysate solution that was used as the medium during the fermentation experiment. This research suggests that it would be possible to produce other chemicals that require iron sulphur proteins using a similar method. Optimising the metabolic pathway in this study through further research would allow for greater production of useful compounds from lignocellulosic biomass. This could potentially reduce future dependence on finite oil resources and polluting methods of production.

Science Daily, 6 September 2019

http://www.sciencedaily.com

Gossip

Cleaning up hydrogen peroxide production

2019-09-18

The most common process for making hydrogen peroxide begins with a highly toxic, flammable working solution that is combined with hydrogen, filtered, combined with oxygen, mixed in water, and then concentrated to extremely high levels for shipping. The transportation process is equally convoluted. Most of the massive chemical plants that make hydrogen peroxide are located in Russia and China. For big markets like the U.S. oil and gas industry, concentrated hydrogen peroxide is usually freighted to America, diluted, then shipped via rail or truck to places like western Texas, where a service company buys it and pumps it for the customer. All of this complexity masks the fact that hydrogen peroxide is structurally simple. In fact, a large group of specialised proteins, called enzymes, have long been known to work with hydrogen peroxide in various biological systems. But translating that knowledge into a more natural way to create hydrogen peroxide has proven difficult—until recently. For the past few years, the start-up Solugen, which was co-founded by an MIT alumnus, has been producing hydrogen peroxide by combining genetically modified enzymes with organic compounds like plant sugars. The reaction creates bio-based hydrogen peroxide as well as organic acids, and the company says this method is cheaper, safer, and far less toxic than traditional processes. Solugen currently has two pilot facilities in Texas that produce more than 10 tons of hydrogen peroxide per day, with a much larger site opening next summer. The technology has the potential to decarbonise the production of an extremely common chemical used for a host of consumer and industrial applications. Science companies like Solugen are often started by researchers who have spent years studying a specific problem. Their success often hinges on securing government grants or corporate partnerships. But Solugen has a much more colourful history. The company can attribute its success to research into pancreatic cancer, a Facebook group of float spa enthusiasts, a fruitful splurge at Home Depot, and the emergence of several fields that make Solugen's solution possible. Solugen co-founder Gaurab Chakrabarti was in medical school studying pancreatic cancer in 2015 when he discovered an enzyme in cancer cells that could function in extremely high concentrations of hydrogen peroxide. The enzyme required another expensive chemical to be useful in reactions, so Chakrabarti partnered with Sean Hunt SM '13 Ph.D. '16, whom he'd befriended while attending medical school with Hunt' wife. Hunt was studying more traditional chemical processing methods for his Ph.D. when Chakrabarti showed him the enzyme. "My background is not in biotech, so I'm kind of the recovering biotech sceptic," Hunt says. "I learned

Solugen's proprietary process for producing hydrogen peroxide uses modified enzymes and inexpensive compounds like sugar. It is currently being used in two pilot facilities that create more than 10 tons of the chemical every day.

about enzymes in school, and everyone knew how active and selective they were, but they were just so unstable and hard to manufacture." Using computational protein design methods, Hunt and Chakrabarti were able to genetically modify the enzyme to make it produce hydrogen peroxide at room temperature when combined with cheap organic compounds like sugar. Soon after, the founders were finalists in the 2016 MIT $100K pitch competition, earning $10,000. But they still weren't sure the technology was worth pursuing. Then they were contacted by a Facebook group of float spa enthusiasts. Float spas suspend people in salty waters while shutting out all noise and light to help them achieve sensory deprivation. Hydrogen peroxide is used to keep float spa waters clean. "There's about 400 float spas in the U.S., and they're all on one Facebook group, and one owner saw our MIT $100K pitch video and shared it to the Facebook group," Hunt explains. "That's really what made us continue Solugen that summer. Because we were contacted by these float spa owners saying, "This is how much we pay for peroxide. If you guys can make it, we'll buy it."" Emboldened, the founders rented cheap lab space in Dallas and sent one of their early enzyme designs to a protein manufacturer in China. Then Hunt spent $7,000 at Home Depot to create a pilot reactor he describes as "this little PVC bubble column." Running out of money, the founders bought 55-gallon drums of sugar and ran them through the reactor with their enzyme, watching triumphantly as organic acids and hydrogen peroxide came out the other end. The founders began selling all the peroxide they could produce, sometimes sleeping on the floor to keep the reactor running through the night. By December of 2016, they were making $10,000 a month selling pails of peroxide to the float spa community. The company used its PVC bubble reactor until the summer of 2017, when they built a fully automated reactor capable of producing 10 times more hydrogen peroxide. That's when they moved into the oil and gas industry.

A big, toxic problem

As companies pump oil and gas out of the ground, they generate large amounts of contaminated salt water that needs to be treated or disposed of. Billions of gallons of such water are produced every day in the U.S. alone. Hydrogen peroxide is commonly used in the treatment process, but the traditional methods for creating hydrogen peroxide, in addition to being dangerous, leave a huge carbon footprint associated with the constant venting of the working solution. "What I really love about this is it's a true environmental crisis that I think we're making a big difference on," Hunt says, noting other chemicals used to treat wastewater are

extremely toxic and don't biodegrade like hydrogen peroxide does. Solugen's current production facilities ship concentrated forms of hydrogen peroxide, but the founders plan on building "minimills" next to oil and gas plants that don't require concentration and dilution, to further reduce costs and improve sustainability. "When we were building these things out, we realised that because we're doing all this chemistry with enzymes where it's room temperature, in water, and low pressure, it's very safe, and as a result we can build these small plants," Hunt says. "That's really exciting for us. … For instance, you can sell hydrogen peroxide for $2 a gallon. It costs $1.50 a gallon just to ship it to the customer. The freight is almost the price of the chemical. And in some instances, it's more than the chemical itself." Solugen's solution is also intriguing because it couldn't have existed until recently. To make its proprietary enzymes, the company is leveraging fairly new methods for computational protein design and genetic engineering. It also relies on an industry of protein contract manufacturers that can produce large amounts of engineered enzymes for far cheaper than what would have been possible even five years ago. Looking forward, Hunt says Solugen's infrastructure could be used to co-produce hundreds of different organic acids by changing the enzymes and compounds being mixed. One of the co-products he's most excited about is acetic acid, which is used to make vinegar. Acetic acid is also used in the production of important materials like polyester fibre and plastic. "Hydrogen peroxide and acetic acid are fundamental building blocks for our economy," Hunt says. "We see Solugen as a platform [for other solutions]. In the long term, that's what really excites us."

Phys.org, 6 September 2019

http://phys.org

Chemists used photonic crystals to develop a flexible smart skin that reacts to heat and sunlight while maintaining a near constant volume.

Chameleon inspires 'smart skin' that changes colour in the sun

2019-09-18

A chameleon can alter the colour of its skin so it either blends into the background to hide or stands out to defend its territory and attract a mate. The chameleon makes this trick look easy, using photonic crystals in its skin. Scientists, however, have struggled to make a photonic crystal "smart skin" that changes colour in response to the environment, without also changing in size. The journal ACS Nano is publishing research led by chemists at Emory University that found a solution to the problem. They developed a flexible smart skin that reacts to heat and sunlight while maintaining a near constant volume. "Watching a chameleon change

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colours gave me the idea for the breakthrough," says first author Yixiao Dong, a PhD candidate in Emory's Department of Chemistry. "We've developed a new concept for a colour-changing smart skin, based on observations of how nature does it." "Scientists in the field of photonic crystals have been working for a long time to try to create color-changing smart skins for a range of potential applications, such as camouflage, chemical sensing and anti-counterfeiting tags, " adds Khalid Salaita, senior author of the paper and an Emory professor of chemistry. "While our work is still in the fundamental stages, we've established the principles for a new approach to explore and build upon." Besides chameleons, many other creatures have evolved the ability to change colour. The stripes on a neon tetra fish, for example, turn from deep indigo to blue-green when they swim into sunlight. The coloration in these organisms is not based on pigments, but on tiny particles in a repeating pattern, known as photonic crystals. The periodicity in these particles causes the material to interfere with wavelengths of light. Although the particles themselves are colourless, the precise spacing between them allows certain light waves to pass through them while rejecting others. The visible colours produced change depending on factors such as lighting conditions or shifts in the distance between the particles. The iridescence of some butterfly wings and the feathers of peacocks are among many other examples of photonic crystals in nature. If you put strawberries into a blender, Dong explains, the resulting liquid will be red because the colour of the strawberries comes from pigment. If you grind up iridescent butterfly wings, however, the result will be a dull powder because the rainbow colours were not based on pigments, but on what is known as "structural colour." The structure of the photonic crystal arrays is destroyed when the butterfly wings are ground up. To mimic chameleons and create an artificial smart skin, scientists have experimented with embedding photonic crystal arrays into flexible, water-containing polymers, or hydrogels. Expanding or contracting the hydrogel changes the spacing between the arrays, resulting in a colour change. The problem, however, is that the accordion-like action needed to generate a visible change in hue causes the hydrogel to significantly grow or shrink in size, leading to structural instability and buckling of the material. "No one wants a camouflage cloak that shrinks to change colour," Salaita notes. Dong was pondering the problem while watching YouTube videos of a chameleon. "I wanted to understand why a chameleon doesn't get bigger or smaller as it changes colour, but remains its original size," he says. In close-up, time-lapsed images of the chameleon changing hues, Dong noticed that the arrays of photonic crystals did not cover the entire skin but were spread out within a dark matrix. As the photonic crystals turned different colours, these patches of colour

remained the same distance apart. Dong hypothesised that the skin cells making up the dark matrix somehow adjusted to compensate for the shifts in the photonic crystals. "I wondered if we could design something similar -- a composite structure of photonic crystal arrays embedded into a strain-accommodating matrix," Dong says. The researchers used magnets to arrange patterns of photonic crystals containing iron oxide within a hydrogel. They then embedded these arrays into a second, non-colour-changing hydrogel. The second, springy hydrogel was mechanically matched to the first hydrogel to compensate for shifts in distances between the photonic crystals. When heated, this strain-accommodating smart skin (SASS) changes colour but maintains a near-constant size. Dong also tested the material in sunlight, fabricating SASS films into the shape of a fish, in homage to the neon tetra, as well as into the shape of a leaf. When exposed to natural sunlight for 10 minutes, the SASS films shifted from orange to green, without changing in size. "We've provided a general framework to guide the future design of artificial smart skins," Dong says. "There is still a long way to go for real-life applications, but it's exciting to push the field another step further." The research was supported by the Biological Technologies Office of the Defence Advanced Research Projects Agency (DARPA), the National Institutes of Health and the Robert P. Apkarian Integrated Electron Microscopy Core.

Science Daily, 11 September 2019

http://www.sciencedaily.com

Researchers use light to control high-speed chemical reactions in a new way

2019-09-18

Researchers have adopted a novel technique to observe high-speed reactions. A special kind of reaction observed with this method could lead to new optical nanotechnology.

Many natural and synthetic chemical systems react and change their properties in the presence of certain kinds of light. These reactions can occur too quickly for ordinary instruments to see. For the first time, researchers adopted a novel technique to observe the high-speed reactions. A special kind of reaction observed with this method could lead to new optical nanotechnology. In chemistry, molecules can be manipulated in different ways to produce different things. Isomerization, for example, is a process which changes the arrangement of a molecule but leaves constituent atoms as they are. The process is found in natural systems such as the retina of the eye, and artificial systems like certain kinds of chemical synthesis. In many cases isomerization essentially makes a particular region of molecules either more or less ordered. Photoisomerization is a type of isomerization which is activated by light

and it takes place quicker than the blink of an eye. Professor Takashi Kato from the Department of Chemistry and colleagues subjected liquid-crystal molecules of the chemical compound azobenzene to specific frequencies of UV light. The photoisomerization of a single azobenzene molecule typically occurs on a timescale of hundreds of femtoseconds (quadrillionths of a second). That's roughly a billionth to a trillionth the time it typically takes you to blink! The researchers found the molecule then triggers molecular interactions in liquid crystals on timescales of hundreds of picoseconds (trillionths of a second). "We have shown how to change the shape of azobenzene molecules from a straight rod shape to a slightly bent shape in a process triggered by photo-irradiation of UV light. This bending could translate to some mechanical or electronic function," said Kato. "The reaction propagates through neighbouring molecules in the sample, meaning it is an extremely efficient process." This reaction does not take place in isolation, however; it occurs within a sample of soft matter the function of which depends on the constituent molecules and their behaviours. In this case, soft matter could mean anything from an artificial muscle to flexible photographic sensors or even things not yet imagined. The important fact is that the initial reaction which typically takes only hundreds of femtoseconds initiates a response in the surrounding soft matter in around a hundred picoseconds, and does so efficiently. "This is the fastest intermolecular motion ever observed within soft matter. In fact, what we wanted to observe was so fast we had to use some very specialised methods to acquire data and to visualise what took place during these miniscule timeframes," continued Kato. "This would not have been possible without some unique handmade spectral instruments made by my colleague Associate Professor Masaki Hada from the University of Tsukuba." The methods are known as ultrafast transient transmission spectroscopy, which is an accurate way to record the makeup of a molecular sample, and ultrafast time-resolved electron diffraction, which is analogous to an X-ray and is how images of the reaction were observed. Note that both methods are called "ultrafast," which just goes to show other methods would have been insufficient to capture data with the time resolution the researchers desired. "I have worked on ordered molecular assemblies such as self-assembling systems for more than 35 years as a chemist since I was a graduate student. This research advances the fundamental chemistry of photoresponsive molecules in soft matter as well as their ultrafast photomechanical applications," concluded Kato. "It is a real privilege for myself and colleagues to work on this kind of project.

We hope this may contribute to the design of molecular-based materials such as soft-body mechanisms and photo-functional materials."

Science Daily, 13 September 2019

http://www.sciencedaily.com

Virtual reality used to highlight uranium contamination

2019-09-18

The arts collective Bombshelltoe has collected 360-degree footage of Churchrock, New Mexico, to show how people and the land have changed since a 1979 uranium mill spill, Gallup Independent reports. The project started four years ago after Washington, D.C.-based nuclear policy program manager Lovely Umayam met Navajo activist Sunny Dooley at an event in Santa Fe. "Sunny asked us during this meeting, 'Where is your heart?' And it caught my - along with everyone else's - attention," Umayam said. In 1979, a dam on the Navajo Nation near Church Rock broke at a uranium mill's evaporation pond, releasing 94 million gallons (356 million litres) of radioactive waste to the Puerco River. It was the largest accidental release of radioactive material in United States history and three times the radiation released at the Three Mile Island accident. The radiation contaminated not only water but the food chain. Cattle in western New Mexico later showed higher levels of radiation. Dooley, who lives in Chi Chil Tah, New Mexico, said she has felt the direct effects of the big spill that went down the Rio Puerco and contaminated the water and soil in her community. During a recent presentation of the virtual reality footage, Dooley talked about her daily life of not being able to have running water in her home because it is contaminated. "I have to come to Gallup to get my water and take it back home," she said. Umayam said the group wanted to use the new technology of virtual reality with the stories to bring a true experience and show the impact of uranium mining. She said the project is close to being finished, but with every presentation they get more information and make tweaks to the system.

Activists are using virtual reality technology to focus on areas of the Navajo Nation affected by uranium contamination.

Tech Xplore, 15 September 2019

https://techxplore.com/

Gossip

New topological insulator reroutes photonic 'traffic' on the fly

2019-09-18

Topological insulators are a game-changing class of materials; charged particles can flow freely on their edges and route themselves around defects, but can't pass through their interiors. This perfect surface conduction holds promise for fast and efficient electronic circuits, though engineers must contend with the fact that the interiors of such materials are effectively wasted space. Now, researchers from the University of Pennsylvania, where topological insulators were first discovered in 2005, have shown a way to fulfil that promise in a field where physical space is at an even bigger premium: photonics. They have shown, for the first time, a way for a topological insulator to make use of its entire footprint. By using photons instead of electrons, photonic chips promise even faster data transfer speeds and information-dense applications, but the components necessary for building them remain considerably larger than their electronic counterparts, due to the lack of efficient data-routing architecture. A photonic topological insulator with edges that can be redefined on the fly, however, would help solve the footprint problem. Being able to route these "roads" around one another as needed means the entire interior bulk could be used to efficiently build data links. Researchers at Penn's School of Engineering and Applied Science have built and tested such a device for the first time, publishing their findings in the journal Science. "This could have a big impact on large-information capacity applications, like 5G, or even 6G, cellphone networks," says Liang Feng, assistant professor in Penn Engineering's Departments of Materials Science and Engineering and Electrical and Systems Engineering. "We think this may be the first practical application of topological insulators," he says. The data centres that form the backbone of communication networks route calls, texts, email attachments and streaming movies to and between millions of cellular devices. But as the amount of data flowing through these data centres increases, so does the need for high-capacity data routing that can keep up with the demand. The researchers' chip features a tessellated grid of oval rings. Switching from electrons to photons would speed up this process for the upcoming information explosion, but engineers must first design a whole new library of devices for getting those photons from input to output without mixing them up and losing them in the process. Advances in data-processing speed in electronics have relied on making their core components smaller and smaller, but photonics researchers have needed to take a different approach. Feng, Zhao and their colleagues set out to maximise the

complexity of photonic waveguides — the prescribed paths individual photons take on their way from input to output — on a given chip. The researchers' prototype photonic chip is roughly 250 microns squared, and features a tessellated grid of oval rings. By "pumping" the chip with an external laser, targeted to alter the photonic properties of individual rings, they are able to alter which of those rings constitute the boundaries of a waveguide. The result is a reconfigurable topological insulator. By changing the pumping patterns, photons headed in different directions can be routed around each other, allowing photons from multiple data packets to travel through the chip simultaneously, like a complicated highway interchange. "We can define the edges such that photons can go from any input port to any output port, or even to multiple outputs at once," Feng says. "That means the ports-to-footprint ratio is at least two orders of magnitude greater than current state-of-the-art photonic routers and switches." Increased efficiency and speed is not the only advantage of the researchers' approach. "Our system is also robust against unexpected defects," Zhao says. "If one of the rings is damaged by a grain of dust, for example, that damage is just making a new set of edges that we can send photons along." Since the system requires an off-chip laser source to redefine the shape of the waveguides, the researcher's system is not yet small enough to be useful for data centres or other commercial applications. Next steps for the team will be to establish a fast reconfiguring scheme in an integrated fashion.

Phys.org, 13 September 2019

http://phys.org

Researchers pioneer new technique to transform used milk bottles into kayaks and storage tanks

2019-09-18

Researchers at Queen's University Belfast have discovered new ways to convert single-use plastic waste into products such as storage tanks for water and fuel, and sporting goods such as kayaks and canoes, which could help to solve global environmental problems. Today the world produces over 300 million tonnes of plastics every year, which is almost equivalent to the weight of the entire human population. Much of this is single-use and not designed to be recycled, which creates a mountain of waste that enters the natural environment such as plastic pollution in the oceans. However, researchers at the Polymer Processing Research Centre (PPRC) at Queen's University are pioneering innovative manufacturing techniques to turn waste plastic into a wide variety of useful products.

Researchers at Queen's University Belfast have discovered new ways to convert single-use plastic waste into products such as storage tanks for water and fuel, and sporting goods such as kayaks and canoes, which could help to solve global environmental problems.

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Their ground-breaking approach involves a manufacturing process called rotational moulding, which has the potential to economically recycle very large volumes of plastic waste into a wide variety of innovative products such as urban street furniture, storage tanks and marine buoys. The project is funded by Innovate UK through its "Plastics Innovation: Towards Zero Waste" Programme and the researchers are working in collaboration with three industrial partners; Impact Laboratories Ltd in Scotland, Impact Recycling Ltd in England and Harlequin Plastics Ltd in Northern Ireland. Dr. Peter Martin, from the School of Mechanical and Aerospace Engineering at Queen's, explains: "The Polymer Centre at Queen's University Belfast has been leading the way in plastics recycling for over 30 years and our engineers are working on novel techniques that could really help to tackle the huge global issue of single-use waste plastics". "The process starts with flakes of waste plastics being separated and compounded into pellets using the patented technologies of Impact Laboratories and Impact Recycling. "At Queen's we take these pellets and grind them into a fine powder, which is then blended with a proportion of new plastic (polyethylene), heated to over 200°C and then cooled within a mould to transform it into the shape of a new product." Dr. Martin adds: "Our research involves testing to find the optimum combination of blending the plastics and processing conditions so that eventually Harlequin Manufacturing will be able to introduce a range of new rotomoulded products made largely from post-consumer waste. "It is expected that in one product of this kind waste plastic could replace around 30 percent of the new plastic required and use the equivalent of 1,000 old milk bottles in its manufacture." At present, the UK rotational moulding industry alone consumes more than 38,000 tonnes of new plastic, of which more than 11,000 tonnes could be saved. Mark Kearns, Moulding Research Manager at PPRC at Queen's, added: "The rotational moulding process is unique in comparison to other plastic forming methods since it is used to manufacture large products that typically use very large volumes of plastics. "This new process will therefore have significant environmental benefits. The ability to condense and transform large volumes of recycled plastics into products designed to last many years will result in a substantial reduction in the amount of post-consumer waste going to landfill, rivers and the ocean. "It will also help to reduce the quantity of pure polyethylene used in the process, ushering in a new and more sustainable era in the production of rotationally moulded plastics."

Researchers have developed a new method for making highly desirable catalysts from metal nanoparticles that could lead to better fuel cells, among other applications.

Phys.org, 11 September 2019

http://phys.org

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Gem-like nanoparticles of precious metals shine as catalysts

2019-09-18

A Northwestern University research team has developed a new method for making highly desirable catalysts from metal nanoparticles that could lead to better fuel cells, among other applications. The researchers also discovered the method can take spent catalysts and recycle them into active catalysts. Made mainly of precious metals, these coveted catalysts are shaped like gems. Each particle has 24 different faces that present atoms at the surface in ways that make them more catalytically active than those available commercially. The methodology takes basic metal precursors, and, using heat and stabilising trace elements, rapidly transforms their shape into structures that are highly active catalytically. Commercial products such as fuel cells -- important sources of clean energy -- rely on such catalysts. The method is a general one; the study shows it works with five monometallic nanoparticles and a library of bimetallic nanoparticles, spanning seven different metals, including platinum, cobalt and nickel. "Many of these precious metals are responsible for catalysing some of the most important chemical transformations used in the chemical, oil and fuel cell industries," said Chad A. Mirkin, the George B. Rathmann Professor of Chemistry in the Weinberg College of Arts and Sciences, who led the research. "We not only can prepare commercially desirable catalysts, but we can recycle used fuel cell catalysts into the most active forms. Catalysts slowly degrade over time and change, so the fact that we can reclaim and reactivate these catalysts made of expensive materials is extremely valuable," Mirkin said. The study, which includes both simulations and experiments, will be published in the journal Science. The new catalysts are called high-index facet nanoparticle catalysts -- an optimal form for accelerating chemical reactions. Mirkin's team found their platinum catalysts were 20 times faster than the commercial low-index form for the formic acid electrooxidation reaction (based upon platinum content). "Platinum in the high-index facet form is different and better than it is in other nanoparticle forms," said Chris Wolverton, a co-author of the study and the Jerome B. Cohen Professor of Materials Science and Engineering at Northwestern's McCormick School of Engineering. "It's all about chemistry," added Mirkin, who also is director of Northwestern's International Institute for Nanotechnology. Mirkin's multidisciplinary team also includes Vinayak Dravid, the Abraham Harris Professor of Materials Science and Engineering, at McCormick. Catalysis contributes to more than 35% of the world's gross domestic product, according to the American Chemistry Council. The new catalysts can be

made in mass and without the use of ligands, which can compromise catalytic activity. The process that can both create new catalysts and recycle spent catalysts is fast and scalable. Mirkin said the technology may not be far away from being used commercially. "This type of technology is ready to be scaled up and utilized widely in the catalysis community," he said.

Science Daily, 12 September 2019

http://www.sciencedaily.com

'Soft tactile logic' tech distributes decision-making throughout stretchable material

2019-09-18

Inspired by octopuses, researchers have developed a structure that senses, computes and responds without any centralised processing - creating a device that is not quite a robot and not quite a computer, but has characteristics of both. The new technology holds promise for use in a variety of applications, from soft robotics to prosthetic devices. "We call this 'soft tactile logic,' and have developed a series of prototypes demonstrating its ability to make decisions at the material level - where the sensor is receiving input - rather than relying on a centralised, semiconductor-based logic system," says Michael Dickey, co-corresponding author of a paper on the work and Alcoa Professor of Chemical and Biomolecular Engineering at North Carolina State University. "Our approach was inspired by octopuses, which have a centralised brain, but also have significant neuronal structures throughout their arms. This raises the possibility that the arms can 'make decisions' based on sensory input, without direct instruction from the brain." At the core of the soft tactile logic prototypes is a common structure: pigments that change colour at different temperatures, mixed into a soft, stretchable silicone form. That pigmented silicone contains channels that are filled with metal that is liquid at room temperature, effectively creating a squishy wire nervous system. Pressing or stretching the silicone deforms the liquid metal, which increases its electrical resistance, raising its temperature as current passes through it. The higher temperature triggers colour change in the surrounding temperature-sensitive dyes. In other words, the overall structure has a tunable means of sensing touch and strain. The researchers also developed soft tactile logic prototypes in which this same action - deforming the liquid metal by touch - redistributes electrical energy to other parts of the network, causing material to change colours, activating motors or turning on lights. Touching the silicone in

Inspired by octopuses, researchers have developed a structure that senses, computes and responds without any centralised processing - creating a device that is not quite a robot and not quite a computer, but has character-istics of both.

one spot creates a different response than touching in two spots; in this way, the system carries out simple logic in response to touch. "This is a proof of concept that demonstrates a new way of thinking about how we can engineer decision-making into soft materials," Dickey says. "There are living organisms that can make decisions without relying on a rigid centralised processor. Mimicking that paradigm, we've shown materials-based, distributed logic using entirely soft materials." The researchers are currently exploring ways to make more complex soft circuits, inspired by the sophisticated sensors and actuators found in biological systems. The paper, "Materials tactile logic via innervated soft thermochromic elastomers," is published in the journal Nature Communications.

EurekAlert, 13 September 2019

http://www.eurekalert.org

Semiconducting material more affected by defects than previously thought, research opens up new possibilities for improving performance of halide perovskite

2019-09-18

A promising semiconductor material could be improved if flaws previously thought irrelevant to performance are reduced, according to research published in Nature Communications.

A promising semiconductor material could be improved if flaws previously thought irrelevant to performance are reduced, according to research published in Nature Communications. A group of researchers at Rensselaer Polytechnic Institute and other universities has shown that a specific defect impacts the ability of halide perovskite to hold energy derived from light in the form of electrons. "Defects could be good or bad in semiconductors," said Jian Shi, associate professor of materials science engineering. "For some reason, people did not pay attention to dislocations in halide perovskite, but we have shown that this defect is a problem in halide perovskite." Research on halide perovskite has rapidly improved the efficiency of the material from about a 3% conversion of light to electrical energy to 25% -- equivalent to state-of-the-art silicon solar cells -- over the course of a decade. Researchers wrestled with silicon for decades to reach that material's current level of efficiency. Halide perovskite also has promising carrier dynamics, which are roughly defined as the length of time that light energy absorbed by the material is retained in the form of an excited electron. To make a good prospect for solar energy conversion, electrons in the material must retain their energy long enough to be harvested by an electrode attached to the material, thus completing the conversion of light to electrical energy. The material had long been considered "defect tolerant," meaning flaws

like missing atoms, shoddy bonds across grains of the crystal, and a mismatch known as crystallographic dislocation were not believed to have much impact on efficiency. More recent research has questioned that assumption and found that some defects do affect aspects of the crystal's performance. Shi's team tested whether the defect of crystallographic dislocation impacts carrier dynamics by growing the crystal on two different substrates. One substrate had a strong interaction with the halide perovskite as it was being deposited, producing a higher density of dislocations. The other had a weaker interaction and produced a lower density of dislocations. The results show that dislocations negatively impact the carrier dynamics of halide perovskite. Reducing dislocation densities by more than one order of magnitude is found to lead to an increase of electron lifetime by four times. "A conclusion is that halide perovskite has a similar dislocation effect as conventional semiconductors," Shi said. "We need to be careful of dislocations in halide perovskite, which is a factor people have been ignoring as they work on this material." Shi's last significant work on halide perovskite revealed the role of pressure on this semiconductor's optical properties published in Science Advances in 2018. At Rensselaer, Shi was joined by researchers in both the Department of Materials Science and Engineering and Department of Physics, Applied Physics and Astronomy. Researchers from the Kunming University of Science and Technology, Tsinghua University, University of Science and Technology Beijing, Forschungszentrum Julich, and Brown University also contributed to the research.

EurekAlert, 12 September 2019

http://www.eurekalert.org

Simple copper becomes an effective spintronic component thanks to molecular film

Spin devices get a paint job

2019-09-18

Physicists created a new way to fabricate special kinds of electronic components known as spintronic devices. These high-performance, low-power devices have a promising future, so efficient ways to make them are highly sought after. The new fabrication method is interesting because it uses organic molecules which are relatively easy to configure for different purposes. Layers of molecules could be painted or printed onto metals to create new electronic functions. In a nutshell, spintronic devices may one day supersede many electronic devices. This is because spintronics is a more efficient way to perform some functions that electronics can at present. Whereas electronic devices depend on a flow of charge in the form of electrons in motion, spintronic devices exploit

a different property of electrons known as spin. This is related to the electron's angular momentum and the flow of spin is called a spin current. There are several challenges to realise useful spintronic devices. Among these are to find ways to induce a spin current and once that's achieved, to imbue spintronic components with useful functions such as the ability to retain data for use as high-speed memory. Research Associate Hironari Isshiki and his team from the University of Tokyo's Institute for Solid State Physics have found a novel and elegantly simple way to tackle both of these complex challenges. "We successfully demonstrated an efficient conversion of spin current to charge current in a copper sample thanks to a simple coat of 'paint.' This layer is only one molecule thick and comprises an organic substance," said Isshiki. "The device's conversion efficiency is comparable to that of devices made with inorganic metallic materials such as platinum or bismuth. However, in comparison to the inorganic materials, organic materials are much easier to manipulate in order to produce different functionality." This organic layer is made of a substance called lead(II) phthalocyanine. A spin current injected into the surface covered by the molecule is efficiently converted to a familiar charge current. The researchers experimented with layers of different thickness to see which would be most effective. When the layer was a single molecule thick, the molecules aligned into an ordered arrangement which yielded the most efficient spin to charge current conversion. "Organic molecules in particular offer spintronic researchers a high degree of design freedom as they are relatively easy to work with. The kinds of functional components we hope to see are things that could be useful in the field of high-performance computing or in low-power devices," explained Isshiki. "The incredibly thin layers required also mean we might one day create flexible devices or even devices you could create with a special kind of printer." The next steps for Isshiki and colleagues are to explore other configurations of organic layers on conductive materials to realize novel spin functionalities. They also wish to investigate conversion of charge into spin current, the reverse process to that seen in this demonstration. This area of research aims to greatly accelerate the study of spintronics with organic molecules.

EurekAlert, 12 September 2019

http://www.eurekalert.org

Cutting acrylamide in fried and baked snacks

2019-09-18

In 2002, the discovery of acrylamide in certain snacks rattled consumers and the food industry. Acrylamide, a probable human carcinogen, forms

by a chemical reaction during baking or frying. Although experts say it's impossible to completely eliminate acrylamide from crackers, cookies and potato chips, food manufacturers are working to reduce the compound's levels, according to an article in Chemical and Engineering News (C&EN), the weekly news magazine of the American Chemical Society. The Malliard reaction is a chemical process in which amino acids and sugars react during baking or frying to give foods a brown crust and toasty flavour. However, in addition to mouth-watering organic compounds, the reaction produces acrylamide, Senior Editor Melody Bomgardner writes. Acrylamide forms when the amino acid asparagine reacts with reducing sugars, such as fructose. Although it isn't possible to completely remove acrylamide and still have the snacks people enjoy, food manufacturers are exploring strategies to reduce levels of the probable carcinogen in foods. The ingredient suppliers Novozymes, Kerry and DSM all offer products for acrylamide reduction based on the enzyme asparaginase. When added to uncooked foods, this enzyme converts asparagine to aspartic acid, which does not form acrylamide. Using a combination of genetic and bioinformatics tools, Novozymes found a way to make large amounts of several versions of asparaginase tailored to specific foods. For organic food companies that wish to avoid genetically modified organisms (GMOs), Kerry has licensed a non-GMO, asparaginase-producing yeast that can be added to uncooked foods. In a different approach, the Idaho potato producer J.R. Simplot introduced a GM potato variety that produces lower levels of asparagine and sugars. With stricter regulations on acrylamide levels expected within the next 2 years, work on acrylamide reduction using other approaches, including gene editing, continues.

Phys.org, 11 September 2019

http://phys.org

By combining a common food and water additive, pholyphosphate salts, with MXene materials, researchers at Drexel have discovered a way to slow the oxidation process when they are exposed to water.

A dash of salt could fortify MXene 'supermaterials' against oxidation

2019-09-18

They can store electricity better than almost any material on Earth, block an onslaught of electromagnetic interference, and sniff out the faintest trace of toxins in the air, but MXenes, the latest super-material-in-waiting, have trouble with water. Like a rake left out in the rain, they oxidize, and quickly, when stored or mixed in water. It's an issue of consequence, considering some of the most promising applications require combining MXene flakes in water to make things like conductive ink and spray coatings. A breakthrough, recently published by Drexel University

Gossip

researchers in a German chemistry journal, showing that a common water-softening additive can help to preserve the flakes in water, could be the key to its future viability. These atomically thin, layered materials, which were discovered at Drexel in 2011, owe their exceptional abilities, in part, to their surface chemistry and physical structure. But the source of MXenes' unique properties is also likely their weakness when it comes to oxidation, according to the research published by a team of researchers from Drexel's College of Engineering. "Oxidation of MXenes has always been a problem," according to Varun Natu, a doctoral researcher in the College and a co-author of the paper "Edge Capping of 2-D-MXene Sheets with Polyanionic Salts to Mitigate Oxidation in Aqueous Colloidal Suspensions," which was published in the journal Angewandte Chemie. "The most common titanium carbide MXenes show signs of oxidation when stored for a week or so in water; other chemistries oxidize within days." Oxygen is a problem, not only because it reacts with MXenes—like it would a rusty rake—but it also changes their surface chemistry and morphology, which ultimately diminishes their performance when it comes to tasks like passing and storing electricity. Distinguished Professor Michel Barsoum's group in the Department of Materials Science and Engineering, which was part of the team that discovered MXenes and has been exploring their applications, had been seeking a way to prevent MXenes from oxidising in water for several years. Its breakthrough came after a related discovery showed how oxidation begins at the edges of the MXene sheets. Basoum's team showed a few months ago, that while the MXenes' layers have a negative surface charge, the edges of the sheets actually have a positive charge. This discovery, plus the fact, established in the clay literature, that negative entities are attracted to the edges of the clay particles led to the breakthrough. "When you dissolve polyphosphate salts in water, they dissociate into the long negatively changed chains of polyphosphates and positive entities or cations. The former are attracted to the positive MXene edges, cap them and shut down, or greatly reduce, the oxidation process. It is simple electrostatics. Once these chains sit at the MXene edges they block the direct contact of water and air reducing the rate of oxidation," said Natu. Using advanced microscopy techniques available in the lab of co-author Mitra Taheri, Ph.D., Professor in the College, the researchers were able to show that the polyphosphate chains indeed were attracted to the positive edges. And capping the edges of the layers with an inert compound in this way effectively shields the reactive parts of the material from direct contact with water and/or oxygen, which substantially slows the oxidation process. Armed with protective polyphosphate caps, MXene flakes in the study lasted more than a month in water exposed to air without any sign of oxidation. "This

discovery finally makes long-term storage of MXenes possible which can make its industrial scale processing viable," Barsoum said. "Before our discovery the most common methods proposed were, drying the MXenes and storing them in a vacuum, storing under Argon atmospheres, using organic solvents to make MXene colloids or to store under liquid nitrogen. But all these methods are not cost effective, energy efficient or scalable. Making polyphosphate addition the best method to prevent oxidation to date." Barsoum's group tested its theory with three different salts on two different MXene compositions, showing that a variety of molecules can be used effectively to cap the flakes. While Drexel researchers have already illuminated the possibility of using MXenes for applications in mobile technology, energy storage, wireless communication, water filtration and health care, this work could lead to advances in surface and edge engineering of MXenes to optimise them for these jobs and others. The team is also looking into similar methods for preserving MXenes in dried form, which would also broaden possibilities for its use.

Phys.org, 10 September 2019

http://phys.org

The newly discovered architecture of a copper-nitrenoid complex could revolutionise chemical synthesis

2019-09-18

Betley and his team of collaborators have characterised the architecture of a copper-nitrenoid complex, a catalyst hunted for over a half century.

To make soap, just insert an oxygen atom into a carbon-hydrogen bond. The recipe may sound simple. But carbon-hydrogen bonds, like gum stuck in hair, are difficult to pull apart. Since they provide the foundation for far more than just soap, finding a way to break that stubborn pair could revolutionise how chemical industries produce everything from pharmaceuticals to household goods. Now, researchers at Harvard University and Cornell University have done just that: For the first time, they discovered exactly how a reactive copper-nitrene catalyst—which like the peanut butter used to loosen gum's grip on hair, helps nudge a chemical reaction to occur—could transform one of those strong carbon-hydrogen bonds into a carbon-nitrogen bond, a valuable building block for chemical synthesis. In a paper published in Science, Kurtis Carsch, a Ph.D. student in the Graduate School of Arts and Sciences at Harvard University, Ted Betley, the Erving Professor of Chemistry at Harvard, Kyle Lancaster, Associate Professor of Chemistry at Cornell University, and their team of collaborators, not only describe how a reactive copper-nitrene catalyst performs its magic, but also how to bottle the tool to break those stubborn carbon-hydrogen bonds and make products like solvents,

detergents, and dyes with less waste, energy, and cost. Industries often forge the foundation of such products (amines) through a multi-step process: First, raw alkane materials are converted to reactive molecules, often with high-cost, sometimes noxious catalysts. Then, the transformed substrate needs to exchange a chemical group, which often requires a whole new catalytic system. Avoiding that intermediate step—and instead instantly inserting the desired function directly into the starting material—could reduce the overall materials, energy, cost, and potentially even the toxicity of the process. That's what Betley and his team aimed to do: Find a catalyst that could skip chemical steps. Even though researchers have hunted for the exact make-up of a reactive copper-nitrene catalyst for over a half century and even speculated that copper and nitrogen might be the core of the chemical tool, the exact formation of the pair's electrons remained unknown. "Electrons are like real estate, man. Location is everything," Betley said. "The disposition of electrons in a molecule is intimately tied to its reactivity," said Lancaster, who, along with Ida DiMucci, a graduate student in his lab, helped establish the inventories of electrons on the copper and the nitrogen. Using X-ray spectroscopy to find energies where photons would be absorbed—the mark of an electron's absence—they found two distinct holes on the nitrogen. "This flavour of nitrogen—in which you have these two electrons missing—has been implicated in reactivity for decades, but nobody has provided direct experimental evidence for such a species." They have now. Typically, if a copper atom binds to a nitrogen, both give up some of their electrons to form a covalent bond, in which they share the electrons equitably. "In this case," Betley said, "it's the nitrogen with two holes on it, so it has two free radicals and it's just bound by a lone pair into the copper." That binding prevents the volatile nitrene from whizzing off and performing destructive chemistry with whatever gets in its way. When someone gets a cut on their leg, for example, the body sends out a reactive oxygen species, similar to these nitrene radicals. The reactive oxygen species attacks invading parasites or infectious agents, but they can damage DNA, too. So, to contain the reactive nitrene, first-author Carsch built a massive cage in the form of a ligand. The ligand—like organic shrubbery surrounding the copper nitrene pair—keeps the catalyst intact. Cut back that shrubbery and introduce another substance—like a carbon-hydrogen bond—and the fiery nitrene gets to work. Betley calls the catalyst a skeleton key, a tool with the potential to unlock bonds that would otherwise be too strong to use in synthesis. "Hopefully, we can generate these chemical species that are now going to be so reactive that they render the most inert kind of substances we have around us as something we can play with," he said. "That would be really, really powerful." Since the building blocks—like

copper and amines—are abundant and cheap, the skeleton key could unlock more practical ways to make pharmaceuticals or household products. When Carsch first made the molecule, "he was literally bounding with joy," Betley said. "I was like, 'OK, settle down.'" But the results got more interesting: the nitrene reacts better than expected even though "the molecule has no right to be stable," and the bonding structure looked different than any of the designs proposed during the last six decades of research. "Had we proposed it at the outset, I think people would have scoffed at us." Even though Betley chased this elusive species—what Lancaster calls "big game hunting"—ever since he launched his lab in 2007, he cares less about his win and more about his collaborators. "I get all my enjoyment from seeing Kurtis and my other students get super fired up about what they've actually been able to make." Carsch faced both critics and chemical walls but persisted in his hunt nonetheless. "I'm glad he's stubborn, as stubborn as I am," Betley said. They both might be as stubborn as the bonds they can now break. At Cornell, when Lancaster and fifth-year graduate student DiMucci confirmed the findings, he "sent a rather colourful email" to the Betley team. But he, too, credits his collaborators. DiMucci spent seven days at the Stanford Synchrotron Radiation Lightsource analysing the catalyst's electronic structure with their team. "Without their new experimental capabilities," Lancaster said, "we really would not have had the signal to noise and the low background that made identifying this thing pretty easy." Next, the team could draw inspiration from this new design to build catalysts with even broader-reaching applications, like mirroring nature's way of converting dangerous methane into methanol. "A real holy grail would be to say, 'OK, that C-H bond there, that particular one in this molecule, I want to turn that into a C-N bond or a C-O bond,'" Lancaster said. That may be a distant goal, but his so-called "dream team" could be the right one to hunt down the solution.

Phys.org, 12 September 2019

http://phys.org

Green light affects this chemical compound in a different way than blue light. The molecule is of interest to computer industry as it can be easily controlled.

Molecule properties change through light

2019-09-18

In the field of computer engineering, magnetically switchable materials play a significant role in data storage. A team from the Cluster of Excellence Ruhr Explores Solvation at Ruhr-Universität Bochum (RUB) has developed and manufactured a novel molecule called 3-methoxy-9-fluorenylidene. What's special about it: its magnetic properties can

be controlled through light of different colours. This might be of use for computer industry. The researchers working with Professor Wolfram Sander at the Chair of Organic Chemistry II outline their findings in the journal Angewandte Chemie on 14 August 2019.

Broad application range of magnetic materials

Magnetism is indispensable in computer engineering. Magnetism controls, for example, the information flow from the computer to magnetic storage media such as hard disks. Moreover, magnetic storage devices use read/write heads in the form of magnets that identify (i.e. read), or alter (i.e. write) the magnetisation patterns on the hard disk.

Methoxy group controls magnetic properties

Developed by Wolfram Sander and his team, the organic molecule 3-methoxy-9-fluorenylidene is based on a fluorine scaffold with a methoxy group attached in the shape of a rotational tail. The researchers have figured out that the molecule's magnetic properties are determined by the orientation of the methoxy group, which changes its conformation depending on the kind of light that hits it. Blue light switches the methoxy group into the "up" conformation forming the diamagnetic and less reactive singlet state. Whereas green light rotates the methoxy group down at the molecule, which results in the paramagnetic triplet state that has a higher reactivity against molecular hydrogen.

Interesting for research and industry

Because of its properties, 3-methoxy-9-fluorenylidene is of great interest to research. "Using this group of atoms, we can study the spin dependence of reactions. It could also play a role in the development of novel switchable magnetic materials and chemical sensors," predicts Sander. Compared with traditional ferromagnetic materials, 3-methoxy-9-fluorenylidene offers considerable advantages: magnetism can be switched on and off through visible light. Moreover, organic magnets are not brittle like conventional magnets, but flexible and can be processed like plastics.

The snag

However, the molecule does have one drawback: it is stable only at extremely low temperatures. "This is why we are researching into

Curiosities

A Woman Has Bled to Death After a Rooster Pecked Her Varicose Vein

2019-09-19

A new case study describes an unusual accident: a 76-year-old woman has bled to death after a rooster pecked at her leg. The tragic death has prompted doctors to draw attention to an extremely common blood vessel condition that often comes with age. The attack took place on a rural property in South Australia, as the older woman was collecting eggs from her chicken coop. A few aggressive pecks from the resident rooster was all it took for her to haemorrhage and collapse. The autopsy later revealed two puncture wounds in her lower left leg, one of which was right over a varicose vein. These are weakened or damaged blood vessels with valves that do not work properly, so the blood struggles to flow effectively back to the heart. According to the case study, when the woman realised, she was bleeding, she tried to get her husband's attention. Leaving a trail of blood back to the house, she collapsed on the driveway and died before help arrived. The deceased woman was reportedly overweight, with a medical history of high blood pressure and diabetes. Her varicose veins had been operated on in the past, but the condition was severe enough that she had trouble walking. "There are a couple of messages, one is never trust a rooster … the second one is if you've got varicose veins, get something done about it," pathologist Roger Byard told the Australian Broadcasting Corporation. Varicose ruptures are a chronic clinical condition that is usually benign. Severe cases, however, can lead to serious repercussions if left untreated. When a varicose vein is ruptured, it can trigger arterial bleeding and a serious medical emergency, which can be fatal. Death from haemorrhage due to a varicose rupture is uncommon; one study found just 66 cases described in reports between 1973 and 2012. But there are characteristics which make some people more susceptible, including old age, social isolation, and underlying medical conditions, like liver cirrhosis or ischemic heart disease. Smaller varicose veins usually aren't an issue, but if the condition is more severe, there are multiple treatment options, some of which are less invasive than others. "The fragility of the skin and underlying soft tissues in older individuals means that varicose veins are vulnerable to injury from relatively minor trauma," pathologists explain in the clinical study. "This has, on occasion, resulted in significant haemorrhage." The authors also describe a similar example, communicated to them by a fellow doctor, where a house cat scratched a person's lower leg, causing an uncontrollable and ultimately fatal bleed. The rooster, in this case, pierced an equally unfortunate spot. "This case demonstrates that even relatively

A new case study describes an unusual accident: a 76-year-old woman has bled to death after a rooster pecked at her leg.

small domestic animals may be able to inflict lethal injuries in individuals if there are specific vascular vulnerabilities present," the case study reads. Something to keep in mind. The findings were published in Forensic Science, Medicine and Pathology.

Science Alert, 6 September 2019

http://www.sciencealert.com.au

The psychobiotics revolution has implications for us all

2019-09-19

"KILLS all known germs" was once an effective advertising slogan. Now we know this promise isn't as desirable as it might sound. Not all "germs" are bad. In fact, you couldn't survive without help from the many microbes that live on and within you. A thriving microbiome isn't just essential for your physical health, though. In the latest twist to this story it turns out that microbes in your gut also influence your mood. These so-called psychobiotics are intimately entwined with us from birth. They help shape the developing human brain, particularly the areas associated with emotions. They also exert day-to-day control over how we feel. The mystery of how single-celled organisms have an effect on our minds from a distance is starting to be solved. Intriguingly, bacteria in our intestinal tract can produce almost all the same neurotransmitters we generate in our brains, and they have a hotline from the gut to the head. As yet, we don't know exactly which microbes influence our moods. Still, we know enough about psychobiotics to start to benefit from them. Experiments show that consuming certain probiotic foods can help people cope with anxiety and depression, the most common causes of disability worldwide. With more research and a better understanding of the bacteria involved, psychobiotics look set to offer a real alternative to drugs and cognitive behavioural therapy for a range of mood disorders. Some will find this liberating, because it offers hope of taking back control from a mental health condition. But the psychobiotics revolution has implications for all. Anyone can cultivate feel-good bacteria in their gut with the right kind of diet. You really can eat yourself happier.

The discovery that gut bacteria can boost our mood may herald a new way of treating mental health conditions

New Scientist, 4 September 2019

http://www.newscientist.com/

Curiosities

Why do fragrances cause health problems for one in three people?

2019-09-19

One in three adults say that fragranced products cause them health problems, and one in 10 say the effects are so bad that they have missed work or lost jobs, suggests a survey of more than 4000 people. But it is unclear whether the symptoms are direct physiological responses, or whether they have a psychological component. Fragrances are used to mask smells or add a pleasant aroma to a wide range of products, including many cosmetics, cleaning supplies, air fresheners, laundry detergents and soaps. Previous surveys have found that people believe that they experience a range of health issues when exposed to such fragrances. An increasing number of people are describing themselves as having "chemical sensitivity", in which low levels of chemicals in their everyday environment trigger a diverse range of symptoms. But little is known about what may be causing these problems. To get a better understanding of how common fragrance sensitivity is and how it affects daily life, Anne Steinemann at the University of Melbourne, Australia, surveyed about 1100 people from each of the US, Australia, the UK and Sweden. These were randomly recruited from a research survey database of more than 6 million people. One in three respondents said fragranced products affected their health. The highest rates were reported in the US, where nearly 35 per cent said they had problems with fragrances. The lowest reported incidence was in the UK, where nearly 28 per cent of respondents said they were adversely affected. One in five respondents said that their health had been affected by being near someone wearing a fragranced product, and one in six said they experienced health problems around air fresheners or in rooms cleaned with fragranced products. The most common health complaint was respiratory problems, affecting one in six participants, followed by migraines and mucosal symptoms such as watery or red eyes. Nine per cent of respondents said they had become sick from fragrances at work, missed workdays or even lost their job due to it. People say they have to avoid using restrooms, using soap in public bathrooms and leave shops due to fragrances.

One in three adults say that fragranced products cause them health problems, and one in 10 say the effects are so bad that they have missed work or lost jobs, suggests a survey of more than 4000 people.

<u>All in the mind?</u>

Given that one in three people say that these products harm their health, fragrance sensitivity may qualify as an epidemic, says Steinemann. The study backs up previous research showing these types of complaints are reasonably common, especially among people with asthma, rhinitis, autism and those who get migraines, says Connie Katelaris, an

immunologist at Campbelltown Hospital, in Australia. However, there are no standardised diagnostic tests used to determine whether these effects are physiological or psychological, she says. Symptoms such as runny noses or eyes suggest that sensitivity to fragrances is a physiological reaction, says Katelaris. But it is also possible that some people experience psychological reactions. Katelaris says that some people worry about the effects such chemicals have on the body and that this could trigger physical symptoms. Physical and psychological responses can also combine in complex ways, says Katelaris. Having a physical reaction like a headache after smelling paint on one occasion might later cause someone to become anxious the next time they walk into a new building, because they anticipate new paint smells. Steinemann says that those surveyed would like to see fragrances removed from public spaces. She would like to see products carry clear labels that flag the presence of a fragrances and the ingredients they contain. But Guy Marks, of the University of New South Wales, Australia, says that more evidence on the physiological responses people have to fragrances would be needed to justify such actions. Although seven per cent of those surveyed said that fragrances triggered asthma attacks, many people with poorly treated asthma find their sensitivity to fragrances subsides once their asthma is better controlled, says Marks.

New Scientist, 6 September 2019

http://www.newscientist.com/

Ebola survivors face kidney problems and risk of premature death

2019-09-19

People who survive Ebola virus infection face a dramatically higher risk of dying - probably from severe kidney damage - within a year of leaving hospital, according to a study of survivors of an epidemic in Guinea. Researchers who followed more than 1,100 survivors of the Ebola virus outbreak - which swept through West Africa in the world's largest epidemic from 2013 to 2016 - found their mortality rates a year after discharge from hospital were up to five times higher than expected in general Guinean population. Death rates were higher among those who were in hospital for longer, the study found, suggesting that patients who had more severe cases of Ebola may have yet higher post-disease risks. The findings show an urgent need for more investigation of the long-term effects of Ebola infection, the researchers said, especially since the number of Ebola survivors has risen significantly with two large epidemics in the

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past five years. A continuing outbreak of Ebola in Democratic Republic of Congo has become the world's second largest in history since it began in August 2018. It has spread to infect almost 3,000 people in Congo so far, killing two-thirds of them. In the survivor study, published in the Lancet Infectious Diseases, scientists led by Ibrahima Socé Fall, an emergency response expert at the World Health Organization, followed 1,130 Guinean survivors of the 2013-16 outbreak. Over a follow-up period of an average of 22 months, 59 deaths were reported, of which 37 were tentatively attributed to renal failure based on reports by family members of the symptoms suffered by their dead loved one, the researchers said. It was not possible to give the exact cause or date of death for many patients, they said, since there were few medical documents or autopsies available. Case studies of patients with Ebola, however, have found that the virus can be detected in urine - showing it can infect the kidney - and that some patients with Ebola develop acute kidney injury. "Although cause of death evidence was weak for most patients, renal failure is a biologically plausible cause of death in survivors of Ebola virus disease," said Mory Keita, a medical doctor and epidemiologist from Guinea who is now working with the WHO to help control the Congo Ebola outbreak. Judith Glynn of the London School of Hygiene & Tropical Medicine, who also worked on the research team, said the findings should help emergency response experts focus resources towards higher-risk groups. "Those hospitalised with Ebola for longer may be at greater risk, and could be specifically targeted," she said. The 2013-2016 Ebola outbreak in West Africa was the largest and deadliest ever, killing more than 11,300 people of the 28,000 who were infected.

Reuters Health, 5 September 2019

http://www.reuters.com/news/health

Exercise can do more to lower the risk of premature death for patients with cardio-vascular disease than for healthy people, a new study suggests.

Heart patients may benefit more from exercise than healthy people

2019-09-19

Exercise can do more to lower the risk of premature death for patients with cardiovascular disease than for healthy people, a new study suggests. Healthy people did have a lower chance of dying during the study when they were more physically active. But the beneficial effect of exercise was more pronounced for people with heart problems, researchers reported in the European Heart Journal and at the annual meeting of the European Society of Cardiology in Paris. The study team scored participants' exercise levels and intensity based on a measure known as metabolic equivalent

of task (MET) minutes per week. For optimal health, adults should get at least 500 MET minutes per week. (Because MET minutes can be difficult to calculate, an easier recommendation to follow is to get at least 150 minutes a week of moderate to vigorous exercise.) When people had heart disease, every additional 500 MET minutes per week of exercise was associated with a 14% lower risk of dying from all causes during the study. For healthy people, the same increase in activity was tied to only a 7% lower mortality risk. Altogether, researchers followed 131,558 patients with cardiovascular disease and 310,240 healthy people starting when they were around 60 years old. By the time half of the people had been in the study for at least seven years, those with cardiovascular disease were more than twice as likely to die during the study from all causes than individuals without this condition. "Physical inactivity causes various non-communicable diseases such as coronary heart disease, diabetes, and breast and colon cancers, which ultimately lead to premature mortality," said Dr. Si-Hyuck Kang, a co-author of the study and a researcher at Seoul National University "Physical activity fosters normal growth and metabolism," Kang said by email. "In addition, physical activity can make people feel better, sleep better, and perform daily tasks more easily." While the physiologic benefits of exercise may be similar for people with and without heart disease, it's possible that heart disease patients benefit more from exercise because they have so many more risk factors for a premature death that might be addressed by getting more activity, Kang said. "Physical activity has shown to lower blood pressure and blood (sugar), and (cholesterol)," Kang added. Among people with cardiovascular disease, most had ischemic heart disease, also called coronary heart disease, in which the arteries supplying the heart become narrowed. People with heart disease tended to be older and they were also more likely to have other health issues like diabetes, high blood pressure and elevated cholesterol. The study wasn't a controlled experiment designed to prove whether or how exercise might directly impact the risk of premature death. Researchers relied on questionnaires to assess exercise, which isn't always reliable, and didn't examine activity levels at work or other non-leisure pursuits. Even so, the results underscore the importance of getting moving after a heart attack, said Örjan Ekblom of the Swedish School of Sports and Health Sciences in Stockholm. "Everybody knows that increasing one's amount of exercise or general physical activity is quite a challenge, but I would say that for individuals who have survived a heart attack or similar event, it is indeed important to really try," Ekblom, who wasn't involved in the study, said by email. "It will not happen overnight, over a few weeks or even months, but little by little, one travels far." And if heart patients go the extra mile and get more than the minimum

recommended amount of exercise, they will see more benefits, said Claude Bouchard of the Pennington Biomedical Research Centre in Baton Rouge, Louisiana. "The plateau in the relation between physical activity level versus reduction in the risk of death is reached at a higher level of activity than in adults without cardiovascular disease," Bouchard, who wasn't involved in the study, said by email.

Reuters Health, 4 September 2019

http://www.reuters.com/news/health

Antibiotics Appear To Cut Flu Vaccine Effectiveness

2019-09-19

A new study in healthy adults suggests that antibiotics may reduce flu vaccine effectiveness. The depletion of gut bacteria by antibiotics appears to leave the immune system less able to respond to new challenges, such as exposure to previously unencountered germs or vaccines, says Bali Pulendran, professor of pathology and of microbiology and immunology at the Stanford University School of Medicine. "To our knowledge, this is the first demonstration of the effects of broad-spectrum antibiotics on the immune response in humans—in this case, our response to vaccination—directly induced through the disturbance of our gut bacteria," he says.

A new study in healthy adults suggests that antibiotics may reduce flu vaccine effectiveness.

From Mice To Humans

The idea that the trillions of bacteria inhabiting the human gut play a role in our health is far from new, but it hasn't been rigorously proved. Hard data in humans has been sparse, with causal evidence coming mainly from studies in mice. The new study was inspired by a mouse study that Pulendran and his colleagues conducted in 2011. Those investigators found that mice raised from birth to have germ-free intestinal tracts failed to mount as strong an immune response to vaccination as their normal counterparts. So did mice given antibiotics or bioengineered to lack an immune sensor for flagellin, the chief protein constituent of the threadlike flipper that bacteria use for swimming around. When it comes to responding to vaccination against a previously encountered infectious pathogen, our immune systems are remarkably resilient even in the face of the most severe depletion of our intestinal bacteria. "The question was, does this have any relevance to humans?" Pulendran says. To try to answer this question, he and his associates conducted a study involving 22 adults ages 18 to 45: During the 2014-15 flu season, 11 took broad-spectrum antibiotics over five days and got a flu vaccine on day four; 11 others took no antibiotics but got the flu vaccine on day four, as well. The antibiotics

lowered the gut-bacterial population by 10,000-fold. The resulting loss of overall diversity was detectable for up to one year after the antibiotics were taken. Still, 30 days after vaccination, vaccine-induced increases in antibodies capable of preventing influenza infection were comparable among the two groups. But the participants in this experiment tended to have pretty high levels of those antibodies to begin with, suggesting they'd already had some exposure to the flu strains represented in the current or prior seasons' vaccines.

Flu Vaccine Effectiveness

To see if low counts of gut bacteria might pose a greater obstacle to the immune system's ability to respond to previously unseen elements in a vaccine—such as new viral strains represented in the seasonal flu vaccine—than to those the immune system remembered seeing before, Pulendran's team recruited another 11 similarly aged participants for the 2015-16 season. But this time, they selected only individuals whose low level of flu antibodies indicated low prior exposure to the virus or to the vaccine itself. None of the new recruits had gotten flu vaccinations for at least the past three years. Five individuals got broad-spectrum antibiotics, as in the previous year. The other six served as controls. All 11 got vaccinated. Again, gut-bacteria counts in individuals who received antibiotics plummeted, as in the previous year. But this time there was a big change in levels of an antibody subtype most responsible for countering the influenza virus: This subtype failed to burgeon in the blood in response to the vaccine. Notably, the deficit in this antibody subtype correlated strongly with post-antibiotics decreases in total gut bacteria as well as in flagellin, the bacterial protein, in volunteers' stool samples—a proxy for microbial abundance in the gut.

Lost Resilience

The recipients of the antibiotics exhibited many signs of systemic inflammation—the same immunological signature Pulendran has observed among people ages 65 and older after an influenza vaccination in a prior study. The degree to which antibiotics recipients' immune systems exhibited this bodywide, aging-associated systemic inflammation mirrored the extent of depletion, in participants' blood, of a series of metabolites whose generation requires gut-bacterial assistance. These metabolites, called secondary bile acids, are known to dial down inflammatory processes in the immune system. Intestinal bacteria fashion them from primary bile acids initially produced in the liver. Levels of one important secondary bile acid, lithocholic acid, plunged by 1,000-fold in

the bloodstreams of antibiotic recipients, and was inversely correlated with the amount of inflammation. "The study indicates that when it comes to responding to vaccination against a previously encountered infectious pathogen, our immune systems are remarkably resilient even in the face of the most severe depletion of our intestinal bacteria," Pulendran says. "But they seem to lose this resilience when confronted with a vaccine containing new pathogenic elements of which they have little or no prior memory."

You Should Still Get The Flu Vaccine

The findings, Pulendran says, imply that when next season's flu strain comes along, you want your gut-resident microbes to be in full bloom in order for your immune system to rise to the occasion. Pulendran offers some advice. "Get your annual flu shot," he says. "The greater your inventory of immune memory to influenza strains bearing any resemblance to the one that's coming over the hill, the more likely you'll be able to deal with it, even if your gut microbes are in short supply." Other investigators at Emory University, as well as researchers at the Ragon Institute, the University of Chicago, Georgia State University, and the Food and Drug Administration contributed to the work. The study appears in Cell. Funding came from the National Institutes of Health, the Soffer Endowment, and the Violetta Horton Endowment. Stanford's departments of Pathology and of Microbiology and Immunology also supported the work.

Futurity, 9 September 2019

http://www.futurity.org

Notre-Dame's Toxic Fallout

2019-09-19

The April fire that engulfed Notre-Dame contaminated the cathedral site with clouds of toxic dust and exposed nearby schools, day care centres, public parks and other parts of Paris to alarming levels of lead. The lead came from the cathedral's incinerated roof and spire, and it created a public health threat that stirred increasing anxiety in Paris throughout the summer. Five months after the fire, the French authorities have refused to fully disclose the results of their testing for lead contamination, sowing public confusion, while issuing reassuring statements intended to play down the risks. Their delays and denials have opened the authorities to accusations that they put reconstruction of the cathedral — which President Emmanuel Macron has pledged to

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complete in five years — ahead of the health of thousands of people. A comprehensive investigation by The New York Times has helped fill out an emerging picture of a failed official response. It found significant lapses by the French authorities in alerting the public to health risks, even as their understanding of the danger became clearer. The April 15 blaze nearly destroyed the 850-year-old cathedral and brought immediate scrutiny onto whether adequate fire protections had been in place to safeguard a gem of Gothic architecture visited by some 13 million people a year. Millions around the world watched in horror as the cathedral's roof and spire succumbed to the flames that night and collapsed. But the billowing smoke carried its own hidden danger: massive quantities of lead, according to test results in confidential reports and others released by the government. As fire raged and the roof collapsed, some of the lead covering the roof and spire was dispersed as dust. Levels of lead dust deposited near the cathedral were up to 1,300 times higher than French safety guidelines. The lead spread across central Paris, tests indicate, settling in schools, parks and other public places. More than 6,000 children younger than age 6 live within a half mile of those locations, a Times analysis found. The Times's investigation drew on confidential documents, including warnings by labor inspectors, a police report and previously undisclosed lead measurements by the Culture Ministry. Two French news organisations, Mediapart and Le Canard Enchaîné, have also investigated the lead concerns. The documents, as well as scores of interviews, make clear that the French authorities had indications that lead exposure could be a grave problem within 48 hours of the fire. But it took a month before city officials conducted the first lead tests at a school close to Notre-Dame. Even today, city and regional health officials have not tested every school in the proximity of the cathedral. The tests showed levels of lead dust above the French regulatory standard for buildings hosting children in at least 18-day care centres, preschools and primary schools. In dozens of other public spaces, like plazas and streets, authorities found lead levels up to 60 times over the safety standard. Soil contamination in public parks may be among the biggest concerns. The highest contamination levels, revealed in the confidential Culture Ministry documents obtained by The Times, were at different spots in, or near, the cathedral site. The authorities failed to clean the entire area in the immediate aftermath of the fire and waited four months to finish a full decontamination of the neighbourhood. The Culture Ministry, which is responsible for cleaning the site and rebuilding Notre-Dame, also failed or refused to enforce safety procedures for workers, leaving them exposed to lead levels more than a thousand times the accepted standard. "These are astronomical levels, and the attitude of health authorities is inexplicable," said Annie Thébaud-

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Mony, a prominent public health expert in France, who has been leading public calls for more transparency in the aftermath of the fire. The lead levels were concerning enough that some health experts consulted by The Times advised against taking small children near Notre-Dame, though all agreed it was safe to visit Paris. Some French officials and lead experts have cautioned against "paranoia" and argued that in a city as old as Paris, not all of the high lead levels can be attributed to the Notre-Dame fire. The test results may in part reflect broader underlying problems with lead contamination in Paris.

Lead exposure poses the greatest risk to children, especially under age 6, as well as to pregnant women and nursing mothers, who can pass lead on to their children. If ingested, lead interferes with the normal development of the nervous system and can leave young children with permanent cognitive damage, producing problems that range from the loss of a few I.Q. points to difficulties with reading and a tendency toward aggressive behaviour. Even so, hundreds of children attended schools near Notre-Dame for weeks before the authorities began in mid-May to test for lead levels, or to clean the buildings. "It's almost a no-brainer that if you incinerate hundreds of tons of lead, you're going to have some significant deposition of particles in the neighbourhood," said Matthew J. Chachère, the long-time counsel to the New York City Coalition to End Lead Poisoning. "I would think there would have been sufficient knowledge among public health authorities to realise that this had the potential to cause a great deal of environmental harm," Mr. Chachère said. Notre-Dame is a unique structure in France, and in the aftermath of the fire, the official response was divided between city, regional and national officials. Each had distinct responsibilities, and sometimes competing interests, as lines of authority collided, undermining accountability. City officials, who didn't order lead testing until a month after the fire, said they had wanted to communicate more openly with the public but were following the lead of regional and national agencies. "The state was afraid to make people afraid," said Anne Souyris, the city's deputy mayor in charge of health, who also noted that officials were faced with a singular disaster that left them struggling to navigate regulatory vagaries. "They thought that they would protect people by not communicating about the lead issue," she said. This month, Paris officials opened public schools for a new academic year and said none presented alarming lead levels any longer. Some private schools did not open on time, for fear of lead. Many parents are unconvinced that the schools are lead free, partly because of the lack of transparency from the authorities. Only gradually did public awareness of the problem grow. It took a lawsuit, leaked test results in the French press and public criticism

from experts. Experts have differed on whether the city should conduct mandatory testing on children in the exposed area. Some French experts argue that high lead levels on surfaces do not necessarily correlate with individual children being contaminated. But many children were put at risk. The health authorities' refusal to require testing of children will make it nearly impossible to assess the full extent of exposure, since lead levels reduce over time, as the element is eliminated from the body. "They didn't encourage people to get a lead concentration, they didn't close the schools, the Health Regional Agency didn't send any alert," Ms. Thébaud-Mony said. "The city of Paris hid behind them," she said.

Hundreds of children were exposed

As imposing as a fortress, the Paris Prefecture Police Headquarters sits directly across from Notre-Dame and served as a command centre the night the cathedral burned. As sirens blared and firefighters worried that Notre-Dame might collapse, a day care centre inside the police building was hurriedly closed, for fear it could be crushed by falling debris. Within days, the day care centre, which was for the children of officers, was tested for lead. In some areas, like the "millipede playroom," the tests found lead levels up to 2.5 times the French standard for buildings hosting children, according to a confidential police document. The report offers evidence that the French authorities were aware of the threat of lead contamination within days of the fire but kept quiet. The officers' children were moved to a second day care centre farther away from Notre-Dame, in another building of the headquarters. As many as 80 children would play in this second day care centre in the coming weeks. But it turned out that second building was contaminated, too. New tests revealed more alarming results, which were initially kept from officers, and from the general public. Police authorities did not respond to repeated requests for comment. At the second day care centre, more than 20 measurements showed lead levels at or above the threshold for buildings hosting children. They included the "goblins" playroom and rooms where nurses fed children with baby bottles. Windows in the building had been left open during the fire, according to the confidential police report. Other tests found at least six offices were contaminated with lead levels up to 17 times higher than the regulatory threshold. Experts said the officers could have been vulnerable both to inhaling the dust as it swirled during the fire and ingesting it afterward. "We kept hearing rumours in corridors that made us worried," said one officer, who spoke on the condition of anonymity because of police guidelines, and whose 2-year-old daughter was one of the children who used the playroom. In early May, city officials finally closed the second

day care centre for decontamination and informed officers of the situation. But still no broader alarm was sounded. "We took measures immediately and closed our own day care centres for a month and a half," said Frédéric Guillo, a police officer and representative at the C.G.T., one of France's largest unions. "Why didn't public authorities do anything for the other ones?" he asked. One problem is that different messages were coming from different government agencies. On May 9, the Regional Health Agency released a reassuring statement to the public, merely confirming "the presence of lead dust in the immediate surroundings of the cathedral." At the same time, officials from the Culture Ministry, responsible for Notre-Dame's reconstruction, were playing down the risks in a meeting with public health authorities, labor inspectors, police and local officials, according to one person who attended.

Antoine-Marie Préaut, a regional conservator at the Culture Ministry, denied that and said the authorities took the concerns seriously. "We haven't been downplaying the risk over lead contamination," he said in a telephone interview. The city's public schools and day care centres near Notre-Dame remained open for weeks after the fire. In early May, city officials issued "recommendations" for cleaning at schools around the cathedral but offered little guidance to parents. Then, without any public notice, the city began conducting the first tests for lead at public primary schools in mid-May. Ms. Souyris, the deputy mayor, said it was up to the heads of schools to inform parents of the tests. Some did but others did not, The Times found. During the next two weeks, nine primary schools and day care centres close to Notre-Dame were tested — six of which had lead levels up to 2.5 times the regulatory threshold. Schools closed for the summer in July, and public anxiety began to mount. In early July, Mediapart, a French investigative website, published the first leaked documents about lead concerns in and near Notre-Dame. Parents demanded greater clarity about the risks, and environmental groups sounded alarms. Earlier, the regional health agency had "invited" pregnant women and children under 7 to have their lead levels tested. Now the agency focused on schools, widening the perimeter of concern and the number of schools for testing. As results came in, it became clear that more and more schools had alarming levels of lead. By then, children had already left for summer vacation, though some schools around Notre-Dame continued to operate as summer camps. In at least 18-day care centres, preschools and primary schools, tests revealed lead levels over the recommended threshold. Two schools being used as summer camps were closed after tests revealed alarming lead levels. At one, Saint-Benoît, in the Sixth Arrondissement — just across the Seine, on the Left Bank — several

places in the school and its playground showed lead levels up to seven times recommended levels. Among the rooms over the threshold was the cafeteria, where children are likely to put their hands in their mouths and on their food. Because Saint-Benoît and most other schools had not conducted tests for lead before the fire, city authorities have warned that high levels could have other historical causes. "It's highly unlikely that the levels found at Saint-Benoît were linked to the fire," argued Ariel Weil, the mayor of the city's Fourth Arrondissement, home to the cathedral. But he added, "If Notre-Dame has triggered an overall cleaning of Paris, so much the better." The head of the school did not respond to requests for comment. Whatever the source of the lead, in early August, workers in full, white protective outfits sprayed blue gel on the schoolyard's asphalt before tearing it up. It remains unclear why all schools in the area were not tested sooner. Many of the test results were made public only after public pressure mounted. A few weeks later, in late July, a French environmental group filed a lawsuit against the government over its delayed response. In a telephone interview, Ms. Souyris, the Paris deputy mayor in charge of public health, said local authorities had not publicized the test results because they wanted to coordinate with state officials. She also said, as do some other officials, that a city as old as Paris has a lead problem that long predates the Notre-Dame fire. "We are facing a widespread issue around lead," Ms. Souyris said. "It goes beyond Notre-Dame, but since there is no norm for public spaces, we need a bigger plan against lead in Paris." With some exceptions, lead regulations in France are guidelines, not legally binding rules. That makes them essentially, optional. The Health Ministry has ruled that lead levels over 70 micrograms per square meter, or 6.5 micrograms per square foot, amount to "a risk of lead contamination for exposed children" and should lead to "a quick intervention." But that pertains to indoor spaces. In Paris, officials have waffled on the proper outdoor threshold. In the weeks after the fire, they cited 93 micrograms per square foot as the guideline. But as public criticism reached a fever pitch in mid-July, regional health officials essentially raised the limit, citing a new figure of 464. At Combattants de la Nueve, a tiny square where children play from a kindergarten less than a quarter mile from Notre-Dame, tests in late August showed soaring lead levels. The Regional Health Agency said people should "expect" high blood lead levels with such exposure and "invited" the children who attended the kindergarten to have their blood lead tested. "This is a huge concern," said Perry Gottesfeld, executive director of Occupational Knowledge International, and an expert on lead testing and health, "because we know that soil contamination in this range is closely linked to elevated blood lead levels." But indoor or outdoor, the guidelines are essentially voluntary, not legally binding.

That regulatory void has created confusion among authorities, reinforcing concerns of parents and other residents. "We could have communicated earlier," Ms. Souyris said. "The fact that we don't even have norms for public spaces may have explained why health authorities took so much time in communicating more."

Worry increased as questions went unanswered

As Parisian families send their children back to school, many are wondering whether their children have been exposed to lead, and whether they are still at risk. "Schools and local authorities first tried to be reassuring," said Anne Souleliac, a mother of three, who lives in the Fifth Arrondissement. "But have we really gotten the measure of the risk? I don't think so." In May, Ms. Souleliac asked the principal at her eldest son's private primary school to conduct lead tests, but her demands were ignored, she said. By August, school officials had pivoted and conducted the tests after officials widened the area of concern. The results were not publicly released, but the opening of the school was delayed for the fall term. In all, five private primary schools did not reopen on time, as the authorities continued to test for lead. Though the Regional Health Agency has resisted calling for mandatory testing of children, the parents of roughly 400 children have had them tested, many on their own initiative, the agency said in a statement. Of those, 8.5 percent showed levels at or above the French regulatory threshold for concern. The agency did not reveal which schools the children attended. Public officials have emphasised that "environmental measurements" conducted as early as the day after the fire had revealed a "good air quality." No mention was made of the hundreds of bystanders who watched Notre-Dame burn and may have been exposed to lead dust in the atmosphere. "It's understandable that parents ask questions," said Dr. Fabien Squinazi, a former head of the Paris Public Health Laboratory who advised the authorities over the summer. "But if children have spent a couple of minutes in a schoolyard with high lead levels and the rest of the day in a classroom that is not contaminated, there is no reason to be worried."

"A high lead level on surfaces doesn't automatically mean that a child has been contaminated," he said. The area that has gotten the most official attention is the Île de la Cité, the island in the Seine where Notre-Dame is located. Local authorities set up a special centre to test children under 7 and pregnant women living there. But for everyone else, including those living in the broader area of concern, lead tests are provided only to people with special prescriptions from doctors. Ms. Souleliac, who works on the Île de la Cité but does not live there, wanted her daughter to be

tested as quickly as possible. But that proved challenging. Her doctor and day care centre were not alarmed at first. "It took health authorities two months to test my daughter, two months to take tests at the day care and at my nanny's apartment," Ms. Souleliac said. "I'm not sure people are aware of how toxic lead can be for young children." When she was finally tested, the girl had 1.1 micrograms of lead per decilitre, below the threshold of 2.5 micrograms. The regulatory threshold for concern in France is 2.5 micrograms per decilitre, but experts warn that any level of lead can cause harm. Catherine Leroy had not thought about potential health risks for her 2½-year-old daughter until news articles mentioned lead concerns and friends warned her about toxic particles. Ms. Leroy, who lives on Rue Chanoinesse, less than 300 feet from the cathedral, took the child for a test in mid-May. The results showed lead levels of 1.9 micrograms per decilitre. The result wasn't alarming, she was told, but state contractors cleaned her apartment anyway because it was deemed to be in a risky zone. "The authorities have poorly communicated about it," Ms. Leroy said on a recent morning, as she took the girl to a nearby park on her bike. "We received information bit by bit," she said. "But we've been feeling a little forgotten."

Those most in danger? The restoration workers

The people exposed to the highest levels of lead have been the workers at the cathedral itself. Amid growing public concern over contamination, the authorities shut down work at Notre-Dame in July, saying stricter measures were needed "in accordance to labor inspection's requests." In fact, work at the site was stopped only after seven alarming letters, dozens of emails and a series of heated meetings between labor inspectors and those trying to carry out reconstruction of Notre-Dame on President Macron's ambitious five-year timetable. The confidential letters from labor inspectors, obtained by The Times, reveal a multitude of lapses that exposed workers to exceptionally high levels of lead. Tests taken inside the cathedral found lead levels up to 588 times above the regulatory threshold. On the plaza, open to workers and security agents, levels were up to 1,300 times higher, according to the Culture Ministry's confidential measurements obtained by The Times. Outside the construction site on the nearby pavements, workers were exposed to lead levels up to 955 times the threshold. A month after the fire, one labor inspector warned that safety gear was not being worn by some workers and urged authorities "to implement, without waiting, measures to protect employees for risks of lead exposure." Adding to the dangers, inspectors noticed that workers operating inside the cathedral were not decontaminating their clothes under their jumpsuits as they left

work. Workers would then bring those clothes back home, exposing their families to possible lead contamination. Their children should be screened, said Dr. Squinazi, the Paris expert. "That's a big criteria," he said. "Children of workers are running a greater risk." When workers started to decontaminate the plaza, in early June, they wore no protection, and had not received any training about lead exposure, the labor inspector found. In a final letter dated July 22, another labor inspector found workers entering the site through the decontamination units that were supposed to be used to let them out. "The current organisation doesn't allow an effective decontamination of the workers," the inspector concluded. The inspector threatened to shut down the site if safety measures weren't followed. Three days later it was. Furious union officials have accused the government of putting the reconstruction of the monument ahead of health concerns. The Culture Ministry rejects the claim. "We're not denying that there has been a risk with lead, but the measures we implemented really soon after the fire have helped avoid exposing workers," said Mr. Préaut, the Culture Ministry conservator. Of the dozens of workers who have been at the site, Mr. Préaut said, three had shown lead levels over the regulatory threshold in their blood. They are being monitored by doctors. The contractors being used say they test their workers, but they have not released the results because of medical confidentiality. Mr. Préaut said lead exposure is a complicated topic, partly because of the lack of clear regulatory thresholds. "There is lead elsewhere in Paris," Mr. Préaut said, "And every time there is construction here, we find some lead around it." Work on the cathedral resumed on 19 August with a host of new safety measures, including foot baths, decontamination showers and disposable underwear. A contracting company decontaminates work clothes. Strict checks have been put in place on entering and leaving the site. Yet even after construction resumed, workers could still be seen wearing no gloves or masks on the northern side of the cathedral. Lead levels in that area were up to 10 times above the recommended threshold, according to the Culture Ministry's own measurements. On the roof, where some workers operated without masks or gloves for months, some measurements were 2,300 times above the safety threshold. Notre-Dame's architect in chief, Philippe Villeneuve, called the lead one of the most complex challenges facing the reconstruction. "The roof, the spire, the vaults, we know how to reconstruct them," he said. "But lead? We don't know the thresholds, or the exact rules to follow." He and others now fear the work will be slowed by the precautions. "We're not working with the same rhythm and constraints anymore," he said, blaming "the lead issue." "We're not done with that lead thing."

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For merchants, the pain is continuing

In the streets around Notre-Dame, business owners have seen revenues plunge since the fire. Tourists have been blocked from some streets, the plaza and the cathedral, once among the most visited sites in the world. Merchants say that city or state inspectors have conducted lead tests in their cafes and restaurants, and that they are safe for customers. At Au Vieux Paris d'Arcole, a restaurant one street away from Notre-Dame, Frédéric Benani, a waiter, said measurements had been taken inside and on the terrace. Visitors who posed for selfies in front of the restaurant's iconic wisteria had no reason for concern, he said. "We don't want people to freak out, it's already been painful enough," said Mr. Benani, who watched the cathedral burn from the window of his apartment above the restaurant. The street adjacent to Notre-Dame was decontaminated in late August. Now, local residents and business owners are trying to balance lingering concerns about whether there is still any danger with fears about their threatened livelihoods. Marie-Madeleine Miquel, or Mado, the 80-year-old owner of three restaurants near the cathedral, said tests had shown no alarming leads levels. Yet she has lost 90 percent of her revenues since the fire, she said. "It's not lead that's going to kill me," she said, sitting in her empty restaurant, as some parts of her street were cordoned so decontamination operations could be completed. "It's the lack of tourists." Others have remained concerned, even as anxiety gives way to uncertainty. "All children haven't been tested, the parents are ill-informed," said Mathé Toullier, the spokeswoman for France's top organisation representing victims of lead poisoning. "We will only know in a couple of years if there are consequences, and they could be terrible."

New York Times, 14 September 2019

http://www.nytimes.com/

The agri-chemical giant has a storied history of using shady tactics to attack critics and influence the media.

Monsanto's Spies

2019-09-19

It was early March when other reporters first noticed Sylvie Barak. About a half a dozen journalists were in a northern California courtroom to cover a third lawsuit alleging that Monsanto's pesticide glyphosate causes cancer. Barak told others that she was a freelancer for the BBC. She was friendly and helpful, listened earnestly as reporters discussed their private lives; she offered parenting tips and shared her thoughts on the trial. Barak also mentioned that she supplemented her income with PR consulting to pay the bills. One night, she invited several of the female reporters to a meet-

and-greet for one of her clients, the European Institute of Innovation & Technology. Barak promised in her email that the event would deliver "warm fuzzies after these 4 weeks of craziness we've just been through!" "It was a girls' night out with free drinks," recalled Kelly Ryerson, a blogger covering the trial for the site Glyphosate Girl, who spoke to HuffPost. "She was very interested in having the reporters meet her client." A photo from that night shows Barak smiling next to Ryerson and two other reporters. HuffPost interviewed one of the reporters, who asked not to be named to avoid association with the incident, which could jeopardise her future employment. "[Barak] would make suggestions about interesting parts of the testimony," the reporter told HuffPost. "And then go on and on about certain points of testimony to try and get it into stories, and it was always bad for the plaintiffs." The reporter said that Barak seemed to be fishing for reporters' views on Monsanto and the trial. She was very interested in having the reporters meet her client. Something else about Barak seemed off. A BBC staff journalist was also covering the trial, which raised the question: Why would the BBC send a freelancer and a staff reporter? When journalists searched the internet for Barak, they noticed that her LinkedIn account said she worked for FTI Consulting, a global business advisory firm that Monsanto and Bayer, Monsanto's parent company, had engaged for consulting. After the reporter sent inquiries about Barak to Bayer, Barak's LinkedIn account changed to describe her as a freelancer. And when an Agence France-Presse reporter inquired, the BBC said Barak wasn't working for them. AFP published a piece in May that revealed parts of the intrigue, but did not name Barak. Much of Barak's social media has since been deleted or locked to outside viewers, including her Twitter, LinkedIn and Instagram accounts. Her deleted Twitter page made no mention of her work for FTI, describing her rather as a "recovering/relapsing journalist." Barak did not respond to multiple requests for comment. FTI staff have previously attempted to obtain information under the guise of journalism. In January, two FTI consultants working for Western Wire — a "news and analysis" website backed by the oil and gas trade group Western Energy Alliance — attempted to question an attorney who represents communities suing Exxon over climate change. Monsanto has also previously employed shadowy networks of consultants, PR firms, and front groups to spy on and influence reporters. And all of it appears to be part of a pattern at the company of using a variety of tactics to intimidate, mislead and discredit journalists and critics. When HuffPost asked about Barak, FTI responded by reissuing a statement from earlier this year, noting that she attended the trial to take notes and that the firm has "initiated an internal review and has since taken necessary and appropriate actions." FTI did not respond to questions about its work for Bayer or Monsanto.

Bayer has denied employing FTI for the trial, and the company did not respond to questions about the consulting firm for this article. "Bayer has an unwavering commitment to sound science and to transparency," the company said in a statement. After the reporter who spoke to HuffPost contacted Bayer, Barak disappeared. Monsanto went on to lose the trial. But Barak's presence was felt in court long after; several people covering or involved in the trial told HuffPost they were left feeling slightly paranoid about who they could trust and who else might be watching them.

Hiring A Firm With A History Of Spying

In early May, an 18-page document made public in the California trial revealed that Monsanto had also hired Hakluyt, a British private investigative firm formed by two veteran MI6 spies in the mid-1990s. Hakluyt keeps a low profile, but it is considered one of the world's elite spy firms. News accounts and court documents have shed some light on its past clients, including Enron and BP; in 2001, the latter deployed a spy posing as a documentary filmmaker to track Greenpeace as it planned a climate change campaign. The Monsanto document offers a rare insight into Hakluyt's work, its tactics and political reach. In a sworn deposition for the trial, former Monsanto attorney Todd Rands testified that Hakluyt agents deliberately hid their links to Monsanto as they gathered information from high-ranking government officials in 2018, including a Trump White House policy adviser and senior officials at the Department of Agriculture and Environmental Protection Agency. "We wanted to make sure that we could hear things about ourselves that people might not say directly to us," said Rands, who also notes in the deposition that he left Monsanto in January 2019 and was then consulting for FTI. The document quotes a staffer at the environmental group Natural Resources Defence Council, who does not appear to have known they were speaking to a Hakluyt representative, stating that their litigation team "has been working overtime and is likely to continue doing so, going after both the EPA and companies." Rebecca Riley, legal director for NRDC's nature program, was appalled to learn that Monsanto had hired private investigators. "We do not know where quotes attributed to NRDC came from," said Riley, "but it is no secret we hold polluters accountable to the law—and we are proud of it." A spokesperson for Hakluyt said the company had no comment on how it gathers information nor about its clients.

When Traditional PR And Less Traditional Methods Collide

While traditional PR companies befriend reporters and crank out press releases to spur news articles, they sometimes deploy more aggressive

tactics. Ketchum PR, which has helped Monsanto in its efforts to combat labelling products containing genetically modified organisms and sway public opinion on the safety of its products, has its own record when it comes to hiring people to spy on journalists. Working on behalf of Dow Chemical at the time, Ketchum hired private security firm Beckett Brown International, Inc. to produce dossiers on scientists, journalists and non-profits working to expose GMO safety concerns, as Mother Jones reported in 2010. The strategy included casing their offices, dumpster diving to collect phone records and confidential meeting notes, and planting operatives within the organisations. We wanted to make sure that we could hear things about ourselves that people might not say directly to us. Ketchum's recent work for Monsanto appears more in line with traditional PR, though it still gathers information on reporters. In 2013, it launched GMO Answers with financing from Monsanto, DuPont and Dow AgroSciences. In a campaign video on GMOs, Ketchum bragged that "positive media coverage has doubled" and that it has closely monitored Twitter conversation to "balance" coverage. As HuffPost reported last month, the firm also worked to develop cosy relationships with reporters covering the beat and created brief bios on several journalists that discussed their contact information, reporting and congressional representatives. Monsanto has also hired PR firm Fleishman Hillard to protect its image and keep tabs on critics. In May, French television channel France 2 and Le Monde revealed that the PR giant had compiled dossiers on more than 200 public figures, including journalists, politicians and scientists, which classified each according to their opinions on glyphosate, GMOs or pesticides in general; their level of support for Monsanto; and their credibility with the public. The revelation was notable, as France and other European countries have legal prohibitions on collecting certain information on people without their consent. A French prosecutor has opened an inquiry into the incident. The dustup landed Bayer in PRWeek magazine for its crisis communications failure. It has since apologized and said it had "decided to suspend our cooperation with the involved external service providers for the time being." Bayer hired an outside law firm to conduct an investigation, which said it found no wrongdoing on Fleishman Hillard's account. Bayer said it does not wish to speculate about an ongoing government investigation. Fleishman Hillard's statement to HuffPost reiterated Bayer's, but it did not address questions about the French inquiry.

A Network Of Third-Party Supporters

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In the latest example of Monsanto's efforts to track journalists, The Guardian reported in August on internal documents from the company's "fusion centre," which worked to discredit reporters and non-profits via third-party actors. In 12 pages of emails, a half-dozen Monsanto staffers strategized on a response to HuffPost's 2016 report that alleged Monsanto harassed Carey Gillam, a former reporter who now works for the non-profit advocacy group U.S. Right To Know. In the emails, the Monsanto staffers note that the interview was getting traction on Twitter with other reporters and food influencers like Michael Pollan and celebrity chef Tom Colicchio. Andy Schaul of Monsanto's fusion centre advised against a direct response by bringing in third parties. Using third-party players to sully critics has long been a critical part of Monsanto's strategy. In 2017, LeMonde's Stéphane Foucart and Stéphane Horel reported on some of the "well-known propaganda websites" linked to Monsanto, such as the Genetic Literacy Project and the American Council on Science and Health. Foucart said that after publication, his social media feeds were inundated with pro-Monsanto trolling, accusing him and other French reporters of being "anti-science." The Genetic Literacy Project's website is registered to ESG Media Metrics, a PR firm operated by Jon Entine. While Entine has attempted to distance the Genetic Literacy Project from Monsanto, in 2015, he and Monsanto's chief of global scientific affairs, Eric Sachs, discussed several topics bedevilling the company via email. Entine told Sachs that GLP had updated a web page discussing GMOs and translated it into Spanish, and asked if there was "any interest in expanding/following up on that project?" Among the people listed on Genetic Literacy Project's "team" webpage is Cameron English, who also put together a website to smear reporters and scientists for the American Council on Science and Health (ACSH). The website was later taken down. In a statement to HuffPost, Bayer said that the company "no longer provides financial support" to the Genetic Literacy Project. Monsanto has sought to hide financial ties to ACSH, but internal documents make clear the company was in a discussion about funding the group to push back on critics of glyphosate. "You will not get a better value for your dollar than ACSH," emailed Monsanto's lead for medical science and outreach, Daniel Goldstein, in February 2015. A month later, he notified ACSH that the money had been approved. Bayer also told HuffPost that the company no longer provides financial support to ACSH.

'There's A Lot Of Weird Shit Going On'

In the California trial, the reporter who first identified Barak as an FTI plant said she, too, saw an uptick in Monsanto's industry partners contacting

her as she covered the trial. Mary Mangan, a writer for Biofortified and the Genetic Literacy Project, contacted her to suggest a scoop on alleged scandalous behaviour on the part of a researcher who has provided expert testimony against Monsanto. She also suggested speaking with a guy named Jay Byrne. The techniques we most often see in corporate espionage —dumpster diving, physical surveillance, and false identities —can supplement more staid documentary and informational research on a target. When the reporter read the documents Mangan forwarded, she found nothing worth reporting. Mangan, she felt, was "playing" her to do a hit job. Out of the blue, Byrne then contacted her on social media to discuss how GMO criticism was part of a Russian influence campaign; when she Googled Byrne, she learned he is Monsanto's former director of communications and now runs the PR firm v-Fluence. His clients have included Monsanto, CropLife, and the American Chemistry Council, and he is the co-author, with Entine, of book that argues against chemical safety regulations. It was then she realised "that there's a lot of weird shit going on." The full nature and extent of this "weird shit" are still unknown, but Monsanto's emails and internal documents released during litigation have brought it into sharper focus. In a January deposition, a Monsanto representative said that in 2016 the company spent "around $16 or 17 million" on activities to defend glyphosate. A July 2019 Monsanto document released during litigation details the company's broad plan to combat Freedom of Information Act requests that have uncovered ties between the company and third-party spokespeople in academia, noting that Byrne was tasked with working with academics to support Monsanto. Eamon Javers is the Washington correspondent at CNBC and author of "Broker, Trader, Lawyer, Spy: The Secret World of Corporate Espionage," which traces the history of corporate spy firms such as Hakluyt. "The techniques we most often see in corporate espionage —dumpster diving, physical surveillance, and false identities —can supplement more staid documentary and informational research on a target," he said. Javers added that the public remains unaware of how these espionage efforts can help shape the news and damage a company's critics. "Reporters are more often interested in whether the information is true or not than where it comes from."

Huff Post, 14 September 2019

http://www.huff.com/

Curiosities

Common insecticide threatens survival of wild, migrating birds

2019-09-19

Migrating songbirds exposed to small amounts of a neonicotinoid pesticide suffered weight loss and migration delays, both of which could reduce their chances of survival, according to a new study. The study is the first to examine the impacts of neonicotinoids—in this case, one called imidacloprid—on wild birds and suggests the pesticides are putting migrating birds at risk during their migration, which hampers their ability to survive and, ultimately, reproduce. "The sublethal effects of imidacloprid on food consumption, body condition, and stopover duration have clear links with survival and reproduction and are predicted to negatively affect populations of migratory birds that commonly use agricultural habitats for refuelling," the authors wrote in a study published today in Science. Neonicotinoids—widely used on corn, cotton, sorghum, soybeans and on some other fruits and vegetables—are thought to be at least partially behind bee declines in recent years and also have been linked to widespread impacts on aquatic insects and invertebrates. Spring migration for birds happens the same time that many farmers are seeding pesticide-treated crops in northern midlatitudes, which is the heart of the Midwest and major U.S. farming regions. Researchers gave small doses—amounts they'd likely be exposed to in the wild—of imidacloprid to white-crowned sparrows during the birds' spring migration through southern Ontario, Canada. "The [doses] here were extremely low … minute," Christy Morrissey, an ecotoxicologist in the University of Saskatchewan's College of Arts and Science and the School of Environment and Sustainability and senior author on the study, told EHN. They measured the birds' body before and after exposure and they used radio transmitters to track them. Migratory birds' main fuel source for flying hundreds of miles during migration is fat – to make the strenuous trips they need to put on about 50 to 100 percent of their body mass in a short period of time with fat, Morrissey said. "They change their whole physiology and become extremely fat in a short period of time and that is burned when they fly," she said. Birds given the highest dose lost 6 percent of their body mass within six hours. Also, the exposure caused birds to stay an average of 3.5 days longer at the stopover site on their migration route compared to birds that weren't dosed. "When exposed to these chemicals it caused this anorexic response, they reduced food consumption and essentially rapidly lost weight," Morrissey said. Morrissey went on: "When we released them with radio tag on, we did not see disorientation, as we expected them to, but quite surprising for us, they didn't fly. They wouldn't leave

Neonicotinoids are harming more than bees.

the stopover site." She said migration is a critical period for birds and any delays in these travels—which include hundreds of miles of nonstop flight —can "seriously" harm nesting and reproduction. "The decision for birds to depart a stopover has to do with their internal fuel stores, as well as good weather conditions, or if there's a headwind, but we controlled for those in our study," Morrissey said. "We think they don't have sufficient fuel in the tank." Such exposures may partially explain why migrant and farmland bird species are declining so dramatically worldwide, Morrissey added. About 74 percent of bird species in North America that rely on farm habitat have suffered population declines since 1966. Morrissey and colleagues say these impacts are likely due to the pesticide suppressing the birds' appetites—which would mean they would eat less food and not have the fuel and energy to re-start their migrating flights. Neonicotinoids are neurotoxic, and overstimulate the nervous system. "[Neonicotonoids] are structurally similar to nicotine — nicotine is an appetite suppressant," Morrissey said. "These low doses could have caused birds to lose their appetite and there could be an additional effect of metabolising the chemical and its general toxicity causes them to lose weight." Morrissey said, while there are differences between species' response to any contaminant, there's "no real reason this would be unique" and only impacting white-crowned sparrows. Most previous studies have reported the pesticides' health impacts to insects, such as bees, however, more and more studies show problems for birds, including:

- A 2015 study that found imidacloprid-treated seeds can kill red-legged partridges and reduce their offspring's immunity;
- A 2013 study that reported three different types of neonicotinoids can reduce egg size and fertilization rate in re-legged partridge;
- A 2017 study—from the same researchers involved in the new study—that found imidacloprid impacted white-crowned sparrows' orientation during migration. (In the new study, disorientation was not one of the impacts).

"Our study shows that this is bigger than the bees — birds can also be harmed by modern neonicotinoid pesticides which should worry us all," said co-author and biologist Bridget Stutchbury of York University in a statement. Morrissey said, in seeking solutions to this exposure, banning individual chemicals will not work. There are "already replacement for neonics—and they're just as toxics as neonics, they're just a different name," she said. Rather we "need to change the whole system to make it more resilient." "Monoculture, single crop agriculture is heavily reliant on chemicals for production, unfortunately, that's just not conducive to

life and biodiversity," she said. "We should incentivise farmers to diversify systems rather than substituting one chemical for another."

Environmental Health News, 13 September 2019

http://www.environmentalhealthnews.org/

High air pollution may raise preterm risk during second pregnancy

2019-09-19

Higher air pollution levels may raise the risk of preterm birth for women in their second pregnancy, a new study shows. Taking in more carbon monoxide during a second pregnancy increased the risk of an expecting mother giving birth prematurely by 51 percent, according to research published in the Journal of Environmental Research and Public Health. Consuming higher levels of nitrogen dioxide raised that risk by 45 percent. The researchers pulled data from the NICHD Consecutive Pregnancy Study on more than 50,000 women who delivered babies at 20 Utah hospitals from 2002 to 2010. They determined which pollutants these women would most likely be exposed to during their second pregnancies. The study showed between 7 to 12 percent of the women had higher exposure to air pollution during their second pregnancy. Higher ozone levels increased their preterm risk by 48 percent and more sulfur dioxide raised the risk by 41 percent. In 2017, preterm birth was the second leading cause of death in babies, according to the Centres for Disease Control and Prevention. Preterm babies are born before 37 weeks. "What surprised us was that among low-risk women, including women who had not delivered preterm before, the risk during the second pregnancy increased significantly when air pollution stayed high or increased," Pauline Mendola, a researcher at the Eunice Kennedy Shriver National Institute of Child Health and Human Development and study lead author, said in a news release.

New research shows that exposure to carbon monoxide, nitrogen dioxide, ozone and sulfur dioxide can increase risk for premature birth during a second pregnancy.

UPI, 12 September 2019

http://www.upi.com

Bones release a hormone that helps us deal with sudden danger

2019-09-19

When faced with a sudden threat, our heart and breathing rate, blood pressure, circulating blood sugar and body temperature increase to prepare our muscles to fight or run away. This fight-or-flight response

is known to be controlled by direct nerve pathways from the brain and hormones released by the adrenal glands. Now, Gerard Karsenty at Columbia University and his colleagues have discovered that a hormone released by bones called osteocalcin also coordinates this response. They found that blood levels of osteocalcin quickly rose in humans when they had to perform a stressful public speaking task. The same thing happened in mice and rats when they were restrained, given electric foot shocks, or exposed to the smell of fox urine. Additional experiments in mice showed that this osteocalcin surge suppressed the body's "rest-and-digest" functions in order to allow the opposite flight-or-fight mechanisms to proceed. The results build on the group's previous work showing that bones release osteocalcin to help the muscles burn fuel during exercise, and that osteocalcin injections in older mice make their ageing muscles more youthful.

Active bones

Together, these findings suggest we need a radical re-think of the role of bones, which have previously been viewed as mostly inert structures, says Karsenty. They may have evolved to protect us from acute danger by activating the flight-or-fight response, optimising muscle function, providing the structural framework needed for our bodies to move and escape, and forming a protective cage around our organs, he says. At this stage, it's unclear why the body has different ways of mounting the flight-or-fight response – through bone, direct nerve pathways and the adrenal glands – but it may be so we have back-ups in place if one system fails, says Robin McAllen at the University of Melbourne. In support of this idea, we know that people with faulty adrenal glands and mice with no adrenal glands can still mount the flight-or-fight response, he says.

New Scientist, 12 September 2019

http://www.newscientist.com/

Technical Notes

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Sorption properties of hydrophobic organic chemicals to micro-sized polystyrene particles

Functions of thioredoxin1 in brain development and in response to environmental chemicals in zebrafish embryos

Selection of new chemicals to be used in conditioned aversion for non-lethal predation control

A critical review of synthetic chemicals in surface waters of the US, the EU and China

Linking chemical exposure to lipid homeostasis: A municipal waste water treatment plant influent is obesogenic for zebrafish larvae

MEDICAL RESEARCH

Susceptibility to the acute toxicity of acrylonitrile in streptozotocin-induced diabetic rats: protective effect of phenethyl isothiocyanate, a phytochemical CYP2E1 inhibitor

Inverse associations of bisphenol A and phthalate metabolites with serum bilirubin levels in Korean population

Predictors of plasma polychlorinated biphenyl concentrations among reproductive-aged black women

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Bisphenol A co-exposure effects: a key factor in understanding BPA's complex mechanism and health outcomes

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PUBLIC HEALTH RESEARCH

Occurrence, distribution and human exposure to 20 organophosphate esters in air, soil, pine needles, river water, and dust samples collected around an airport in New York state, United States

Lung health in the Eastern Mediterranean Region: the need to end designated smoking areas in public places

Neuro-toxic and reproductive effects of BPA

Phthalates in infant cotton clothing: Occurrence and implications for human exposure

Building and Applying Quantitative Adverse Outcome Pathway Models for Chemical Hazard and Risk Assessment