Bulletin Board

MAR. 23, 2018

CHEMWATCH

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CONTACT US

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

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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ASIA PACIFIC

IMAP Tranche 23 open for public comment

2018-03-16

The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has released IMAP- Tranche 23 reports for public comment. The reports were published on 2 March 2018 and are open for comment until 11 May 2018. Further information is available at: https://www.nicnas.gov.au/chemical-information/imap-assessments

NICNAS, 7 March 2018

http://www.nicnas.gov.au

Cancellation of Product Label Approval at the Request of the Holder

2018-03-16

At the request of the holder, the Australian Pesticide and Veterinary Medicine Authority (APVMA) has cancelled the product label approval of the following products:

NICNAS has published IMAP- Tranche 23 reports for public consultation.

Product no.	Product name	Registrant	Product label approval	Date of effect
66684	DUPONT BENEVIA INSECTICIDE	FMC AUSTRALASIA PTY LTD	66684/108781	2 March 2018

The following instructions set out how a person can deal with the product bearing the cancelled product label approval.

SUPPLY

A person may supply or cause to be supplied the above product(s) bearing the cancelled label manufactured prior to 2 March 2018 at wholesale and retail level, until the 2 March 2019. After 2 March 2019 it will be an offence against the Agvet Codes to have possession or custody of the product bearing the cancelled label with the intention to supply, or to supply the product.

USE

Regulatory Update

A person may continue to use the product bearing the cancelled label according to its label instructions until 2 March 2019. Any person who possesses, has custody of, uses, or otherwise deals with the listed product bearing the cancelled label in accordance with the above instructions is taken to have been issued with a permit under the Agvet Codes to so possess, have custody of, use or otherwise deal with the product bearing the cancelled label until 2 March 2019. The supply and use of the product bearing the cancelled label must be in accordance with the conditions of registration or approval, including any conditions relating to the shelf life or expiry date. It is an offence to possess, have custody of, use, or deal with the product bearing the cancelled label listed in the table in a manner that contravenes the above instructions.

APVMA Gazette, 13 March 2018

http://www.apvma.gov.au

High non-compliance among introducers using cosmetics exemption

2018-03-16

Many NICNAS-registered businesses (introducers) using the 'cosmetic use at a concentration of 1% or less' exemption category failed to meet their legal requirements, including not being able to provide information to prove that their introduction meets human health hazards, aquatic toxicity and other environmental criteria. The agency have reminded introducers using the exemption pathway that you must meet all criteria, otherwise it is an offence under the industrial chemicals laws and you could face significant penalties. Introducers can manufacture or import new industrial chemicals into Australia without notifying us in certain circumstances called 'exemptions' (i.e. exempt from notification). Exemptions have strict criteria to protect human health and the environment. If you are having difficulty understanding your obligations please contact NICNAS or consider hiring a legal or regulatory affairs specialist. Unsure if this applies to you? Try "Do I need to notify" questionnaire.

NICNAS, 13 March 2018

http://www.nicnas.gov.au

Many NICNAS-registered businesses (introducers) using the 'cosmetic use at a concentration of 1% or less' exemption category failed to meet their legal requirements, including not being able to provide information to prove that their introduction meets human health hazards, aquatic toxicity and other environmental criteria.

Regulatory Update

China reveals proposal to reorganise regulatory bodies

2018-03-16

China's central government has announced plans to reform the organisational structure of the State Council. If adopted this will see changes to the major regulatory bodies that deal with chemicals, including: The Ministry of Environmental Protection (MEP), State Administration of Work Safety (SAWS) and China Food and Drug Administration (CFDA). Under the proposal the MEP would be renamed the Ministry of Ecological Environment (MEE). And it would take more responsibility for ecological protection and environmental management of chemical substances in China. Some observers believe there will be no impact on revisions to China's management of new chemical substances, MEP order 7, while others believe it casts some uncertainty over who will retain responsibility. "We're not sure whether the progress of the regulation update [MEP order 7] will be affected by the changes of the MEP," said Lisa Zhong, project manager, CNCIC product registration and compliance department. "Generally chemical management work is still managed by MEP. The department is still there, but we're not sure how much it will be affected."

New bodies

SAWS and the fire service department under the Ministry of Public Security would merge into a new ministry – the Ministry of Emergency Management (MEM). It is expected this will continue to take the lead in licensing, registration and storage of hazardous chemical management in China. However, SAWS' responsibility for occupational health supervision will be transferred to the National Health Commission (previously the Ministry of Health). The State Market Supervision Administration Bureau – official English name yet to be confirmed – would replace the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ), the State Administration for Industry and Commerce (SAIC) and CFDA. This bureau will also focus on implementing anti-monopoly policy. Exactly how the former agencies will be structured within the framework is currently unclear. Further information is available at:

- Infographic (in Chinese)
- Infographic in English (less detailed)

- News release (in Chinese)

Chemical Watch, 15 March 2018

http://chemicalwatch.com

China MEP: No Environmental Protection Tax on VOCs?

2018-03-16

On 6th March, 2018, Chinese Ministry of Environmental Protection answered a question regarding the charge on VOCs emission. The previous pollutants emission fee system was abolished to coincide with the implementation of the Environmental Protection Tax, meaning that the pollutants emission fee doesn't apply to VOCs emission now. Additionally, the annexed table 2 of the Law of Environmental Protection Tax, Table of Taxable Pollutants and Pollution Equivalents, didn't include VOCs as a single taxable pollutant. So MEP stated on the website that "VOCs are not subject to either pollutants emission fee, or the environmental protection tax". However, the Table of Taxable Pollutants and Pollution Equivalents does specify 44 kinds of taxable air pollutants. Among them, there are 19 kinds of VOCs. ChemLinked's understanding is that these 19 kinds of VOCs are still subject to the environmental protection tax, although this does seem somewhat contrary to the broad statement made by MEP. A lot of provinces and municipalities directly under the central government implement local charge standards on VOCs emission. After the environmental protection tax was implemented, these charges will be transformed into the form of tax. This is expected to be a long and complicated process for the local government and environmental protection authorities. ChemLinked recommends the industry to consult with local authorities in regards to the specific monitoring and calculation methods because the local governments were authorised to develop stricter emission and levy standards than the Law of Environmental Protection Tax.

On 6th March, 2018, Chinese Ministry of Environmental Protection answered a question regarding the charge on VOCs emission.

Chemlinked, 13 March 2018

http://chemlinked.com/en/news

South Korea revises Accident Precaution Chemicals List

2018-03-16

In February 2018, the South Korea Accident Precaution Chemicals List was updated, adding the following 29 substances to the list:

- Silane [CAS# 7803-62-5]

Regulatory Update

- Isoprene [CAS# 78-79-5]
- Bormine pentafluoride [CAS# 7789-30-2]
- Silicon tetrafluoride [CAS# 7783-61-1]
- Dihydrogen selenide [CAS# 7783-07-5]
- Germanium tetrahydride [CAS# 7782-65-2]
- Bromine [CAS# 7726-95-6]
- Thionyl chloride [CAS# 7719-09-7]
- Trifluoroborane [CAS# 7637-07-2]
- Chloropicrin [CAS# 76-06-2]
- Titanium tetrachloride [CAS# 7550-45-0]
- Trichloroethenylsilane [CAS# 75-94-5]
- Trichloromethylsilane [CAS# 75-79-6]
- Tetramethylsilane [CAS# 75-76-3]
- Silane, dichloromethyl- [CAS# 75-54-7]
- 1,1-Dichloroethene [CAS# 75-35-4]
- Hexafluoro-1,3-butadiene [CAS# 685-63-2]
- Dichlorosilane [CAS# 4109-96-0]
- Disilane [CAS# 1590-87-0]
- Pentacarbonyliron [CAS# 13463-40-6]
- Nickel carbonyl [CAS# 13463-39-3]
- Ammonium hydroxide [CAS# 1336-21-6]
- Tetrafluoroethene [CAS# 116-14-3]
- Silane, trichloroethyl- [CAS# 115-21-9]
- Ethoxyethene [CAS# 109-92-2]
- Hexamethyldisiloxane; HMDS [CAS# 107-46-0]
- Boron trichloride [CAS# 10294-34-5]
- Silicon tetrachloride [CAS# 10026-04-7]
- Trichlorosilane [CAS# 10025-78-2]

Manufacturers or importers of accident precaution chemicals must submit a written confirmation to the Korea Chemical Management Association (KCMA) of the details of a chemical product prior to manufacture or import. In addition, any person who handles accident precaution chemicals must prepare a Risk Management Plan containing spill scenarios, a plan for emergency measures and damage repair every five years. An accident precaution chemical handler must notify the contents

of the Risk Management Plan to local residents using methods such as written notification and group communication at least once per year.

Chemtrac, 8 March 2018

https://www.chemtracglobal.com/news

AMERICA

Court sets 1 June compliance date for US formaldehyde rule

2018-03-16

A United States federal court has set a 1 June compliance date for new formaldehyde emission standards in manufactured wood products, moving up by six months a delayed deadline challenged by NGOs. Last year, the Trump administration issued a final rule pressing pause on the effective dates of a formaldehyde emissions rule that extends nationwide the California Air Resources Board (CARB) standards for plywood, fibreboard, particleboard and finished goods. The move delayed by a year the 12 December 2017 deadline for the new emission standards, record-keeping and labelling provisions. But two NGOs filed suit last October, arguing that the EPA has no authority to delay implementation. And last month, the federal court made a decision in their favour. In an order issued this week, the court imposed a 1 June compliance deadline. This seeks to "avoid the substantial disruption that would result" from retroactively imposing the original deadline, which has passed. Earthjustice – who represented the petitioning organisations Sierra Club and the New Orleans-based group A Community Voice – welcomed the court's decision. The order "levels the competitive playing field for many US-based manufacturers", said Earthjustice, since domestic companies have already reduced formaldehyde levels. American manufacturers "have been undercut by foreign products that don't meet the same safety standards". Formaldehyde, a carcinogen, is used to bind plywood, particleboard and other wood products used in a wide array of consumer products, such as panelling, flooring, cabinets and furniture. The 2010 Formaldehyde Act required the US EPA to issue the regulations by January 2013, to go into effect 180 days after publication. An initial proposal was published in 2013, but the agency did not publish a final regulation until 2016. The agency set the first compliance deadlines for December 2017, but these were delayed by the Trump administration's September 2017 rule. Further Information is available at:

NGOs notch win in legal challenge over long-delayed rule

- Court order
- Formaldehyde rule

Chemical Watch, 15 March 2018

http://chemicalwatch.com

Free NIST Software Can ID Fentanyl Analogues

2018-03-16

The tool contains an algorithm for searching chemical databases that can recognise new fentanyl analogues even if there are no matches in the chemical databases forensic chemists are using to identify illegal drugs. The National Institute of Standards and Technology (NIST) this month released a free software tool to help forensic chemists identify fentanyl analogues, a tool that will help law enforcement trying to cope with the opioids epidemic. The agency noted that "illicit chemists" are always creating new forms of fentanyl, each with a slightly different chemical structure, and while forensic chemists need a way to identify these, the new analogues won't be in the chemical databases they use to identify illegal drugs, at least not yet. The tool contains an algorithm for searching chemical databases that can recognise new fentanyl analogues even if there are no matches in the database. This method, called Hybrid Similarity Search, employs mass spectrometry and was recently described in *Analytical Chemistry*. "If you search for one compound, you will find all the compounds that have a similar chemical structure," said Arun Moorthy, a NIST postdoc fellow and mathematical statistician who worked on the algorithm. "That should help law enforcement and public health authorities react more quickly when a new and deadly drug hits the streets." The agency's news release said this method also works with synthetic cathinones—commonly called "bath salts"—synthetic marijuana, and other drugs.

The tool contains an algorithm for searching chemical databases that can recognise new fentanyl analogues even if there are no matches in the chemical databases forensic chemists are using to identify illegal drugs.

Occupational Health & Safety News, 15 March 2018

http://www.ohsonline.com

California DFA Ordered to Suspend Chemical Activities

2018-03-16

On 22 February 2018, the Superior Court of the State of California, County of Sacramento, issued a judgment granting petition for writ of mandate and declaratory and injunctive relief (Judgment) to suspend further chemical activities undertaken by the California Department of Food

and Agriculture (CDFA) to control or eradicate pests under the Statewide Plant Pest Prevention and Management Program (the Project) until CDFA has certified a Program Environmental Impact Report (PEIR) that corrects violations of the California Environmental Quality Act (CEQA) identified in the court's ruling. CDFA is charged with promoting and protecting the state's agricultural industry and preventing the introduction and spread of injurious insect or animal pests, plant diseases, and noxious weeds. Cal. Food & Agr. Code §§ 4011 401.51 403. CDFA developed the Project to control targeted pests or pathogens, and includes activities such as pest rating (evaluation of a pest's environmental, agricultural, and biological significance); identification, detection, and delimitation of new pest populations; pest management response (which may include eradication and/or control of new or existing pest populations); and prevention of the movement of pests into and within California. The present case was brought after CDFA sought to comply with CEQA by preparing a single PEIR that provides a consolidated set of management practices rather than prepare Environmental Impact Reports (EIR) specific to particular pest management activities. Petitioners alleged that CDFA violated CEQA by certifying the PEIR for the Project and in related proceedings that CDFA violated CEQA by subsequently expanding the Statewide Plant Pest Prevention and Management Program to allow increased use of certain pesticides (Merit 2F and Acelepyrn) for the treatment of Japanese beetles without adequate environmental review. The numerous CEQA violations identified by the court are set forth in a Consolidated Ruling on Submitted Matters (Consolidated Ruling) issued 8 January 2018 and attached as Exhibit 1 to the Judgment. The Consolidated Ruling discusses the following topics:

- Does the PEIR's tiering strategy violate CEQA?
- Does CEQA require the Department to issue a Notice of Determination (NOD) anytime is carries out or approves a site-specific activity?
- Does the PEIR contain an adequate project description?
- Does the PEIR contain an adequate description of the baseline environmental setting?
- Does the PEIR fail to adequately analyse environmental impacts?
- Does the PEIR fail to adequately analyse the Project's cumulative impacts?
- Does the PEIR improperly defer mitigation measures or conceal them as Program Features?
- Does the PEIR fail to adequately consider a range of reasonable alternatives to the Project?

- Did the Department violate CEQA's notice and consultation requirements?
- Did the Department adequately respond to public comments on the DRAFT PEIR?
- Did the Department properly use addenda to modify the PEIR?

The court found multiple, broad-based issues with the PEIR, including, for example, a decision that the PEIR violates CEQA "because it adopts an unlawful tiering strategy, granting the Department authority to implement a broad range of practices without evaluating the site-specific conditions to determine whether the environmental impacts were covered in the PEIR." The Consolidated Ruling also discusses particular failures of the PEIR. Additionally, of potential interest is the court's opinion with regard to whether the PEIR failed to disclose and analyse impacts on sensitive biological resources, which Petitioners argued was based on several grounds:

1. an assumption that spraying "generally" will not occur near sensitive resources and fails to analyse potential impacts from pesticide drift;
2. a conclusion, without substantial evidence, that the Project will have less-than-significant impacts on sensitive species;
3. a conclusion, without substantial evidence, that traps and lures will not have significant impacts on non-target species;
4. the use of improper thresholds of significance for impacts to pollinators and organic farming; and
5. a failure to define, disclose, and analyse impacts on wetlands.

The court did not find issues with the PEIR as it related to CDFA's spraying assumptions and CDFA's determinations of potential impacts on sensitive species, pesticide drift, or organic farming. The court likewise rejected Petitioner's other challenges to the PEIR's analysis of biological impacts, including the PEIR's analysis of traps/lures and of the species evaluated in the Ecological Risk Assessment (ERA). The court did, however, agree with Petitioners that the PEIR improperly ignored potentially significant impacts to pollinators. The court stated that the PEIR considered impacts to pollinators significant only if (1) the pollinator species impacted were "special status," or (2) the impacts would result in a secondary change in the physical environment (such as conversion of land from agricultural to non-agricultural use). The PEIR did not consider whether the Project might adversely impact non-special-status pollinators, despite acknowledging that "healthy pollinator populations are critical to protecting the environmental quality and agricultural resources of the state," and that

"Colony Collapse Disorder" and "pollinator decline" are "ongoing ... serious" problems. The court found that CDFA's "'voluntary' actions to benefit pollinator species are not, by themselves, sufficient to justify the lack of analysis and enforceable mitigation measures for the potentially significant impacts to non-special-status pollinators." The immediate effect of this decision is the inability for CDFA to continue "chemical activities … to control or eradicate pests under the [Statewide Plant Pest Prevention and Management] Program except as authorized under CEQA independent of the PEIR." Should this decision stand, registrants and stakeholders should be interested in whether and how CDFA modifies the PEIR to support its pest control and management activities.

The National Law Review, 15 March 2018

http://www.natlawreview.com

New NIOSH Documents Out on Nanotechnology Workplace Design

2018-03-16

NIOSH has posted four new documents addressing the design of nanotechnology workplaces so that the workers' exposures to nanomaterials while conducting common processes and tasks will be controlled. Engineered nanomaterials are intentionally produced to have at least one primary dimension less than 100 nanometres (nm), and they are used in areas that include medicine, electronics, biomaterials, and consumer products. The workers at sites using or making engineered nanomaterials may inhale nanoparticles on a daily basis, posing a potential respiratory hazard. "Researching, developing, and utilising these nano properties is at the heart of new technology, just as worker safety is at the heart of what we do at NIOSH," NIOSH Director Dr. John Howard said. "The information contained in these new workplace design solution documents provide employers with strategic steps towards making sure their employees stay safe while handling nanomaterials." The four documents provide recommendations on minimizing exposures during:

- handling and weighing of nanomaterials when scooping, pouring, and dumping
- harvesting nanomaterials and cleaning out reactors after materials are produced
- processing nanomaterials after production

Four new documents offers tips on the design and use of exposure controls for nanomaterial production, post processing, and use. They are posters that pose questions employers and workers should consider before starting work with a nanomaterial and list options to reduce exposures to nanomaterials based on the physical form.

- working with nanomaterials of different forms, including dry powders or liquids

Each document offers tips on the design and use of exposure controls for nanomaterial production, post processing, and use. They are posters that pose questions employers and workers should consider before starting work with a nanomaterial and list options to reduce exposures to nanomaterials based on the physical form. The posters can be displayed in a lab or work environment.

Occupational Health & Safety News, 15 March 2018

http://www.ohsonline.com

EUROPE

EU-ToxRisk makes progress on predicting chemical toxicity

2018-03-16

After two years, the EU-ToxRisk project is beginning to have evidence that its battery of alternative tests and models may be able to predict chemical toxicity for read-across purposes.

After two years, the EU-ToxRisk project is beginning to have evidence that its battery of alternative tests and models may be able to predict chemical toxicity for read-across purposes. Although some of the case studies still await key data, early results suggest that predictions broadly match existing *in vivo* data for selected sets of chemicals. These were among the main conclusions of a February stakeholder meeting in the Netherlands on the project, reported in this month's Global Business Briefing. A new regulatory advisory board, with the remit of holding it to its promise of delivering tools that regulators need, also met for the first time, during the event. EU-ToxRisk, which involves 39 partners in 13 countries, focuses on using new approach methodologies for repeated-dose systemic toxicity, with test systems for the lungs, kidneys, liver and nervous system, plus developmental and reproductive toxicity.

AOPs

Alternative tests and computer models are pinned to adverse outcome pathways (AOPs), which describe the key events in the body that lead to an adverse effect following chemical exposure. The project as a whole is built on a set of case studies, each with AOPs, some of which are being identified during it. Most so far have focused on read-across, where chemicals are grouped so that information on target chemicals can be predicted, using test data from reference or source compounds. EU-Tox Risk should shortly begin work on an *ab initio* case study and is discussing

a collaboration with the European Commission's Joint Research Centre. ECHA could propose substances for this, according to Mike Rasenberg, the agency's head of computational assessment. Based on the case study results, ECHA could use *ab initio* tools for prioritisation and/or compliance checks. Further Information is available at: Global Business Briefing

Chemical Watch, 14 March 2018

http://chemicalwatch.com

Turkey KKDIK expert training initiatives gain pace

2018-03-16

Turkey's Ministry of Environment and Urbanisation (MoEU) has authorised four institutions to train chemical assessment experts – a requirement under the country's new KKDIK law. As part of the REACH-like law, Turkey requires such professionals – KDU in Turkish – to be trained and accredited by government-approved agencies before they can sign chemical safety reports (CSRs). KKDIK has an extra annex – Annex 18 – specifying the qualifications necessary to become a KDU. They must undergo at least 64 hours of face-to-face training and pass an exam before they can be issued with a certificate from an accredited organisation. All companies doing business in the chemicals industry in Turkey, including foreign multinationals, must employ trained KDUs. So far four organisations have won the MoEU's approval for training, according to the ministry's website. They are:

- Crad consultancy – Istanbul;
- Turkish Chemical Manufacturers Association (TKSD) – Istanbul;
- NBC certification and training – Ankara; and
- TMMOB - Chamber of Chemical Engineers – Ankara.

Former MoEU official Haydar Hazer leads Crad's training scheme. The consultancy has already run two KDU courses since January, and is preparing to roll out its third soon, an official said. At TKSD, the association's former general secretary Mustafa Bagan will run the expert training courses. NBC is an accredited chemicals training organisation. Its first KDU course will start in Ankara next week, an official said, with regular courses planned in Istanbul, Izmir and Bursa. And TMMOB, a professional organisation with public institution status, said it will offer the courses at any of its 12 branches throughout the country, according to demand. Further information is available at:

- Consultancy information

Turkey's Ministry of Environment and Urbanisation (MoEU) has authorised four institutions to train chemical assessment experts – a requirement under the country's new KKDIK law.

- KKDIK Annex 18
- KKDIK Regulation

Chemical Watch, 14 March 2018

http://chemicalwatch.com

Plant protection products Regulation list of approved active substances updated

2018-03-16

The approval of the following active substances under the Plant Protection Products Regulation (EC) No. 1107/2009 has not been renewed as per Commission Implementing Regulation (EU) 2018/309 of 1 March 2018:

- Propineb (monomer) [CAS# 12071-83-9]
- Propineb (homopolymer) [CAS# 9016-72-2]

As a result, these substances have now been updated in the list of approved active substances (the Annex to Commission Implementing Regulation (EU) No. 540/2011).

The Commission has not renewed the approval of 2 active substances under the Plant Protection Products Regulation.

Chemtrac, 13 March 2018

https://www.chemtracglobal.com/news

Withdrawal of support for 3 active substances from the BPR Review Program

2018-03-16

The following 3 active substance/product-type combinations are no longer considered to be supported in the Biocidal Products Regulation (BPR) Review Program:

- Troclosene sodium [CAS# 2893-78-9] Product type 12 (slimicides)
- Symclosene [CAS# 87-90-1] Product type 12 (slimicides)
- Sodium dichloroisocyanurate dehydrate [CAS# 51580-86-0] Product type 12 (slimicides)

The European Chemicals Agency (ECHA) has published an open invitation which allows interested companies to take over the role of participant for these active substance/product-type combinations. Interested companies have until 9 March 2019 to complete the notification procedure. After this time, an application for evaluation of the active substance/product-type will still be possible, however this application would be as a new active

Regulatory Update

substance and biocidal products containing the active substance would need to remain off the market until an approval decision was made.

Chemtrac, 12 March 2018

https://www.chemtracglobal.com/news

REACH Update

Biocidal Products Committee concludes on two active substances in disinfectants

2018-03-15

The Biocidal (BPC) Products Committee adopted six opinions supporting the approval of two active substances for use in disinfectants. It also concluded on one application for Union authorisation. The BPC supported the approval of the following active substances:

- salicylic acid for product-types 2, 3 and 4;
- 2-phenoxyethanol for product-types 1, 2 and 4.

The BPC also supported an application for Union authorisation for:

- product families containing iodine/PVP-iodine used for teat disinfection of milk-producing animals in veterinary hygiene (product-type 3).

The European Commission together with the EU Member States will take the final decision on the approval of the active substances and on the Union authorisation of biocidal products. The approval of an active substance is granted for a defined number of years, not exceeding 10 years. The committee met from 6 to 7 March 2018. The opinions will be available on ECHA's website in the near future. The next meeting will be held at the end of April 2018. Further information is available at:

- More information about the opinions (annex)
- Approval of active substances
- Authorisation of biocidal products
- Biocidal product-types

ECHA, 9 March 2018

http://echa.europa.eu

The Biocidal (BPC) Products Committee adopted six opinions supporting the approval of two active substances for use in disinfectants.

Benefit from a faster processing of your REACH dossier

2018-03-15

Submit your REACH 2018 registration dossier before the end of March and receive the European Chemical Agency's (ECHA) decision on your registration within three weeks. If you make your submission in April or May, it may take up to three months for you to get ECHA's decision. Companies that submit their registration dossier before the end of March will receive a decision on its completeness from ECHA within 21 days from the submission date. For dossiers submitted from 1 April onwards, it may take until the end of August 2018 to receive a decision. This longer

period to check the completeness of submissions is set out in the REACH Regulation to give ECHA the necessary time to process the high number of registrations expected to arrive close to the 31 May 2018 deadline. Before submitting your dossier, remember to run the Validation assistant in IUCLID both on your dataset and dossier to make sure that you have all the required information. Submit your dossier only once the Validation assistant shows that you do not have any failures. However, if the Validation assistant does not indicate any failures, it does not automatically mean that your dossier is complete. ECHA staff may check some parts of your dossier manually and these completeness checks cannot be replicated with the Validation assistant. Have a look at the available help to get familiar with these manual checks. If you are a lead registrant, keep in mind that you should submit your dossier early enough to allow time for the member registrants to submit their company-specific dossiers by the 31 May 2018 deadline. To support you in your preparations, from 16 March onwards ECHA will keep the dossier submission and communication tool REACH-IT open 24 hours a day, seven days a week. The tool might be closed on Monday mornings from 7:00 to 10:00 EET (Helsinki time) for scheduled maintenance. Support through ECHA's Helpdesk is available during ECHA's business hours as usual. Further information is available at:

- REACH 2018 web pages
- From submission to decision
- Information on manual verifications

ECHA, 14 March 2018

http://echa.europa.eu

PACT updated with 2 finalised RMOA

2018-03-15

On 12 March 2018, the European Chemicals Agency's (ECHA) Public Activities Coordination Tool (PACT) was updated with the following finalised Risk Management Option Analysis (RMOA):

- Calcium cyanamide [CAS# 156-62-7]
- 1,1,2,2,3,3,4,4,4-nonafluorobutane-1-sulphonic acid (PFBS) [CAS# 375-73-5]

This update brought the number of PACT RMOA and hazard assessment substances to 413. ECHA's website gives advanced notice on the substances being considered by authorities for regulatory risk management, together with the routes that are being considered, for

example Harmonised Classification and Labelling (CLP), Authorisation or Restriction. The aim of the advance notice is to increase the predictability and transparency of the process by which substances are considered for regulatory risk management action. The PACT lists the substances for which a RMOA or an informal hazard assessment for PBT/vPvB (persistent, bioaccumulative and toxic/very persistent and very bioaccumulative) properties or endocrine disruptor properties is either under development or has been completed since the implementation of the SVHC Roadmap commenced in February 2013. RMOAs, hazard assessments and their conclusions are compiled on the basis of available information and may change in the light of new information or further assessment.

Chemtrac, 14 March 2018

https://www.chemtracglobal.com/news

ECHA updates list of substances with lead registrants available

2018-03-15

On 9 March 2018, the European Chemicals Agency (ECHA) updated the list of substances for which a lead registrant has been declared in REACH-IT. The list will be updated regularly as more information about substances and joint submissions becomes available.

On 9 March 2018, the European Chemicals Agency (ECHA) updated the list of substances for which a lead registrant has been declared in REACH-IT.

If you are planning to register any of these substances, you can contact the lead registrant company and start negotiating to get access to the joint submission. If the lead registrant of your substance is not visible on the list, you can find their full contact details in REACH-IT. If your pre-registered substance does not yet have a declared lead registrant, you can consider becoming the lead and announcing it to your co-registrants on the pre-SIEF page in REACH-IT. If you manufacture or import a substance into Europe in a quantity greater than 1 tonne/year then you are likely to need to register that substance under REACH and you must start working on your registration dossier as soon as possible. Yordas Group can help you to find the most appropriate and effective route through the regulatory requirements.

Chemtrac, 13 March 2018

https://www.chemtracglobal.com/news

REACH Update

4 CLH consultations launched

2018-03-15

On 12 March 2018, the European Chemicals Agency (ECHA) started a 60-day public commenting period on the Harmonised Classification and Labelling (CLH) proposals for the following substances:

- Fluxapyroxad [CAS# 907204-31-3]
- m-bis(2,3-epoxypropoxy)benzene [CAS# 101-90-6]
- Octhilinone [CAS# 26530-20-1]
- Oxathiapiprolin [CAS# 1003318-67-9]

The deadline for submitting comments is 11 May 2018.

Chemtrac, 13 March 2018

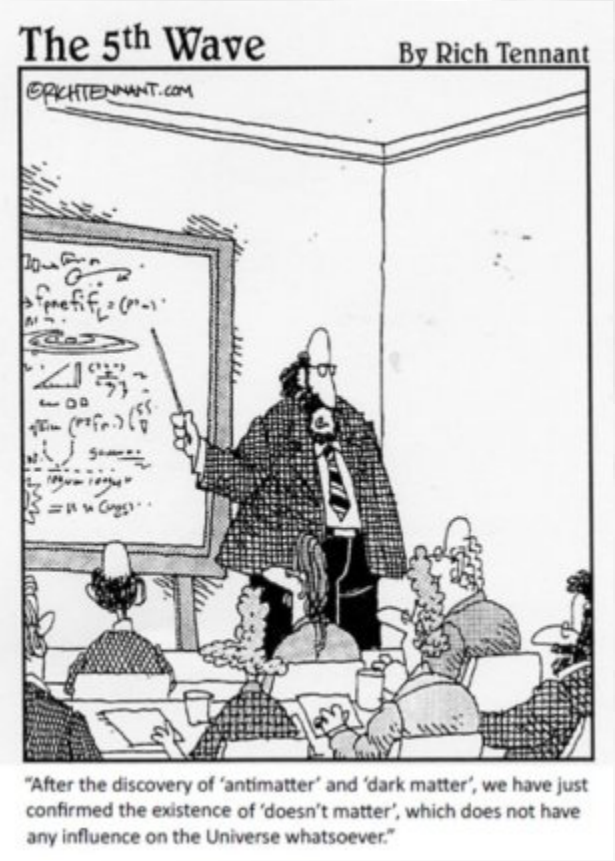
https://www.chemtracglobal.com/news

On 12 March 2018, the European Chemicals Agency (ECHA) started a 60-day public commenting period on the Harmonised Classification and Labelling (CLH) proposals for four substances

Janet's Corner

Doesn't Matter

2018-03-12



"After the discovery of 'antimatter' and 'dark matter', we have just confirmed the existence of 'doesn't matter', which does not have any influence on the Universe whatsoever."

Hazard Alert

Toluene diisocyanate

2018-03-05

Toluene diisocyanate (TDI) is an organic compound with the formula $CH_3C_6H_3(NCO)_2$. Two of the six possible isomers are commercially important: 2,4-TDI (CAS: 584-84-9) and 2,6-TDI (CAS: 91-08-7). 2,4-TDI is produced in the pure state, but TDI is often marketed as 80/20 and 65/35 mixtures of the 2,4 and 2,6 isomers respectively. [1] TDI exist at room temperature as a clear, colourless to pale-yellow liquid with a pungent odour. It decompose in water, but are very soluble in acetone and benzene, and are miscible with ether, diglycol monomethyl ether, carbon tetrachloride, chlorobenzene, kerosene, and olive oil. They are combustible when exposed to heat or flame and darken when exposed to sunlight (IARC 1999, HSDB 2009). [2]

USES [2]

TDI is used primarily to manufacture flexible polyurethane foams for use in furniture, bedding, and automotive and airline seats. Other, smaller uses are for polyurethane elastomers (for automobile bumper covers, industrial rollers, sport soles and boots, and mechanical goods) and coatings (for automotive refinishing, wood finishes, and high-performance anti-corrosion coatings). Toluene diisocyanate–based rigid polyurethane foam is used in household refrigerators and for residential sheathing or commercial roofing in board or laminate form. "Pour-in-place" or "spray-in" rigid foam is used as insulation for truck trailers, railroad freight cars, and cargo containers. Polyurethane-modified alkyds contain approximately 6% to 7% isocyanate, mostly toluene diisocyanates, and are used as coating materials, such as floor finishes, wood finishes, and paints. Moisture-curing coatings are used as wood and concrete sealants and floor finishes. Aircraft, truck, and passenger-car coatings often are composed of toluene diisocyanate prepolymer systems. Castable urethane elastomers are used in applications requiring strength, flexibility, and shock absorption, and are resistant to oil, solvents, and ultraviolet radiation. They are used in adhesive and sealant compounds and in automobile parts, shoe soles, rollerskate wheels, pond liners, and blood bags. They are also used in oil fields and mines. Certain elastomer products are produced from the pure 2,4 isomer rather than the 80:20 mixture.

Toluene diisocyanate (TDI) is an organic compound with the formula CH3C6H3(NCO)2.

SOURCES OF EMISSION & ROUTES OF EXPOSURE

Sources of Emission [3]

- Industry sources: Industrial emissions to air (especially companies producing the materials listed above) or spills.
- Diffuse sources: Emission to air (by outgassing) from products containing TDI.
- Natural sources: There are no known or expected natural sources of TDI emissions.
- Transport sources: No significant mobile emission sources.
- Consumer products: Polyurethane coatings, cement sealers, polyurethane mastic sealants, and polyurethane cushions and pads. Very low emissions of TDI have been infrequently detected from cushions.

Routes of Exposure [4]

The main routes of exposure to TDI are inhalation, ingestion, skin and/or eye contact.

HEALTH EFFECTS [5]

Acute Effects

Acute exposure to high levels of 2,4-toluene diisocyanate in humans, via inhalation, results in severe irritation of the skin, eyes, and nose, and causes nausea and vomiting. Acute animal tests in rats have shown 2,4-toluene diisocyanate to have moderate to extreme acute toxicity from inhalation exposure and low acute toxicity from oral exposure.

Chronic Effects

Chronic inhalation exposure to 2,4-toluene diisocyanate in workers has caused significant decreases in lung function, an asthma-like reaction characterised by wheezing, dyspnea, and bronchial constriction. Animal studies have reported irritation of respiratory tissues, bronchopneumonia, and weight loss from chronic exposure to 2,4-toluene diisocyanate. EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for 2,4-toluene diisocyanate. However, EPA has established an RfC of 0.00007 milligrams per cubic metre (mg/m^3) for the mixture of toluene 2,4- and 2,6-diisocyanate based on respiratory effects in humans.

Reproductive/Developmental Effects

No information is available on the reproductive or developmental effects of 2,4-toluene diisocyanate in humans. No reproductive or developmental effects were observed in rats exposed to a mixture of toluene 2,4- and 2,6-diisocyanate via inhalation.

Cancer Risk

Information is not adequate to determine the carcinogenic effects of 2,4-toluene diisocyanate in humans. Three epidemiology studies did not find an increased occurrence of cancer among exposed workers. Animal studies have reported significantly increased incidences of tumours of the pancreas, liver, and mammary glands from exposure to 2,4-toluene diisocyanate via gavage. Animal studies, via inhalation, did not report an increased incidence of tumours. A study by the National Toxicology Program (NTP) on a mixture of toluene 2,4- and 2,6-diisocyanate administered by gavage showed an increase in tumours of subcutaneous tissues in male and female rats, the pancreas in male rats, mammary gland and liver in female rats, and liver and circulatory system in female mice. EPA has not classified 2,4-toluene diisocyanate for carcinogenicity. IARC has classified 2,4-toluene diisocyanate as a Group 2B, possible human carcinogen.

SAFETY [6]

FIRST AID MEASURES

- Eye contact: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Use lukewarm water if possible. Use fingers to ensure that eyelids are separated and that the eye is being irrigated. Then remove contact lenses, if easily removable, and continue eye irrigation for not less than 15 minutes. Get medical attention.
- Skin contact: Immediately remove contaminated clothing and shoes. Wash off with soap and water. Use lukewarm water if possible. Wash contaminated clothing before re-use. For severe exposures, immediately get under safety shower and begin rinsing. Get medical attention if irritation develops.
- Inhalation: Move to an area free from further exposure. Get medical attention immediately. Administer oxygen or artificial respiration as needed. Asthmatic symptoms may develop and may be immediate or

delayed up to several hours. Extreme asthmatic reactions can be life threatening.

- Ingestion: Do NOT induce vomiting. Wash mouth out with water. Do not give anything by mouth to an unconscious person. Get medical attention.
- Notes to physician: Eyes: Stain for evidence of corneal injury. If cornea is burned, instil antibiotic/steroid preparation as needed. Workplace vapours could produce reversible corneal epithelial oedema impairing vision. Skin: This compound is a skin sensitiser. Treat symptomatically as for contact dermatitis or thermal burn. Ingestion: Treat symptomatically. There is no specific antidote. Inducing vomiting is contraindicated because of the irritating nature of the compound. Inhalation: Treatment is essentially symptomatic. An individual having a dermal or pulmonary sensitisation reaction to this material should be removed from further exposure to any diisocyanate.

Exposure Controls & Personal Protection

Engineering Controls

Local exhaust should be used to maintain levels below the threshold values whenever diisocyanate is handled, processed, or spray-applied. At normal room temperatures (70 F) TDI levels quickly exceed the TLV or PEL unless properly ventilated. Standard reference sources regarding industrial ventilation should be consulted for guidance about adequate ventilation. To ensure that published exposure limits have not been exceeded, monitoring for airborne diisocyanate should become part of the overall employee exposure characterisation program.

Personal Protective Equipment

- Respiratory protection: At normal room temperatures, airborne TDI can exceed limits; therefore, in inadequately ventilated environments, respiratory protection must be worn. The type of respiratory protection selected must comply with the requirements set forth in OSHA's Respiratory Protection Standard (29 CFR1910.134). The type of respiratory protection available includes (1) an atmosphere-supplying respirator such as a self-contained breathing apparatus (SCBA) or a supplied air respirator (SAR) in the positive pressure or continuous flow mode, or (2) an air-purifying respirator (APR). If an APR is selected then (a) the cartridge must be equipped with an end-of-service life indicator (ESLI) certified by NIOSH, or (b) a change out schedule, based on objective information or data that will ensure that the cartridges

are changed out before the end of their service life, must be developed and implemented. Furthermore, if an APR is selected, the airborne diisocyanate concentration must be no greater than 10 times the TLV or PEL. An organic vapour (OV) cartridge is recommended for APR use.

- Hand protection: Gloves should be worn. Nitrile rubber showed excellent resistance. Butyl rubber, neoprene, and PVC are also effective.
- Eye protection: When directly handling liquid product, eye protection is required. Examples of eye protection include a chemical safety goggle, or chemical safety goggle in combination with a full-face shield when there is a greater risk of splash.
- Skin and body protection: Avoid all skin contact. Depending on the conditions of use, cover as much of the exposed skin area as possible with appropriate clothing to prevent skin contact.

REGULATION [3,7]

United States

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
OSHA Permissible Exposure Limit (PEL) - General Industry See 29 CFR 1910.1000 Table Z-1	0.02 ppm (0.14 mg/m^3) Ceiling	HE9	Allergic sensitisation of respiratory tract; asthma
OSHA PEL - Construction Industry See 29 CFR 1926.55 Appendix A	0.02 ppm (0.14 mg/m^3) Ceiling	HE9	Allergic sensitisation of respiratory tract; asthma
OSHA PEL - Shipyard Employment See 29 CFR 1915.1000 Table Z-Shipyards	0.02 ppm (0.14 mg/m^3) Ceiling	HE9	Allergic sensitisation of respiratory tract; asthma

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) See Appendix A	Lowest Feasible Concentration Ca	HE2	Carcinogenicity (pancreas, liver, skin, mammary glands, and circulatory system)
American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2004)*	0.005 ppm (0.036 mg/m^3) TWA 0.02 ppm (0.14 mg/m^3) STEL A4; SEN	HE9	Allergic sensitisation of respiratory tract; asthma
		HE11	Bronchitis, pneumonitis, pulmonary oedema
		HE14	Eye, mucous membrane, and respiratory irritation
CAL/OSHA PELs	0.005 ppm (0.04 mg/m^3) TWA 0.02 ppm Ceiling 0.02 ppm (0.15 mg/m^3) STEL	HE9	Allergic sensitisation of respiratory tract; asthma
		HE11	Bronchitis, pneumonitis, pulmonary oedema
		HE14	Eye, mucous membrane, and respiratory irritation

Australia

Safe Work Australia lists the following exposure Standard:

- 0.02 mg per cubic metre (0.00002 grams per cubic metre), on a time weighted average basis (TWA)
- 0.07 mg per cubic metre (0.00007 grams per cubic metre), for short term exposures (STEL)

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Gossip

Global scientific review reveals effective alternatives to neonicotinoid and fipronil insecticides

2018-03-06

Use of controversial neonicotinoid insecticides ("neonics") in agriculture is not as effective as once thought and can be replaced by advantageous pest-management alternatives, according to a study published in the Springer journal Environmental Science and Pollution Research. This latest publication of the Task Force on Systemic Pesticides reviews 200 studies to assess mass use of systemic insecticides in agriculture, focusing on their effects on crop yields and the development of pest resistance to these compounds after two decades. While neonics, were first brought into use in 1991, documented resistance to them dates as far back as 1996. The authors identify a diverse range of alternative pest-management strategies available for large-scale crop production, concluding that a new framework is needed for a truly sustainable agricultural model that relies mainly on natural ecosystem services instead of highly toxic chemicals. "Over-reliance on systemic insecticides for pest control is inflicting serious damage to the environmental services that underpin agricultural productivity," said Task Force co-chair and scientist at France's National Scientific Research Centre Jean-Marc Bonmatin. "This new research is exciting because it's proven the existence and feasibility of a number of alternative, integrated pest management models -- which are far better for the environment without increasing costs or risks for farmers." Neonicotinoids and the phenylpyrazole fipronil are the world's most sold systemic insecticides. They are routinely used in agriculture as seed treatments even where there is no relevant pest threat. After two decades of extensive neonics use, studies show these pesticides can have disastrous effects on biodiversity and ecosystems, including harm to pollinators. "Insecticides are expected to achieve higher yields and net incomes, but this certainly is not always the case," Bonmatin said. "The overwhelming evidence of negative effects on pollinators and arthropods needs to be weighed against the pest control benefits these systemic insecticides are supposed to produce." The recent report cites many alternative integrated pest-management approaches that can be implemented in combination: at the landscape level (e.g., ecological corridors), by using better farming methods (e.g., crop rotation, resistant crop varieties), by taking advantage of biocontrol (e.g., predators and parasitoids) and through other means (e.g., traps, naturally derived insecticides). The study also details results of an innovative insurance system that protects farmers against undue financial risks without causing environmental harm. Through a "mutual fund" insurance model

Report finds systemic pesticides not as effective as once thought and cites pest resistance as key reason to end mass uses of the harmful substances

piloted in Italy, a collective of farmers manages a mutual fund stock, creating compensation through an interregional distribution of risks. Compensation is commensurate with the financial resources of the fund, which covers risks that private insurance companies currently do not, including climatic adversities such as flooding and damage by wild animals and pests. "Crop insurance programs can be tailored to reduce the financial risk to farmers from potential pest infestations without the environmental costs of insecticide use," Bonmatin said. "And on a cost-recovery basis, insurance premiums are far cheaper than insecticides, so farmers' net incomes rise, too. It's a win-win approach for farmers and the environment." The European Union is expected to vote soon on a proposal to expand its 2013 moratorium to cover most uses of neonics. France will phase-out all neonics next September. Canada is proposing to phase-out all agricultural uses of the neonic imidacloprid, with a final decision expected in December. Separately, Canada has also proposed to cancel some uses of other neonics (clothianadin and thiamethoxam) but would continue to permit their main use as seed treatments. "Regulators need to realize that if we want sustainable agricultural practices, we need a more restrictive regulatory framework and programs to support farmers making the switch," Bonmatin said. "Our findings on the availability of alternatives will be particularly relevant where new restrictions on neonics are being considered."

EurekAlert, 26 February 2018

http://www.eurekalert.org

Clever coating opens door to smart windows

2018-03-06

New ultra-thin coating responds to heat and cold

Researchers from RMIT University in Melbourne Australia have developed a new ultra-thin coating that responds to heat and cold, opening the door to "smart windows". The self-modifying coating, which is a thousand times thinner than a human hair, works by automatically letting in more heat when it's cold and blocking the sun's rays when it's hot. Smart windows have the ability to naturally regulate temperatures inside a building, leading to major environmental benefits and significant financial savings. Lead investigator Associate Professor Madhu Bhaskaran said the breakthrough will help meet future energy needs and create temperature-responsive buildings. "We are making it possible to manufacture smart windows that block heat during summer and retain heat inside when the weather cools," Bhaskaran said. "We lose most of our energy in buildings through windows. This makes maintaining buildings at a certain

temperature a very wasteful and unavoidable process. "Our technology will potentially cut the rising costs of air-conditioning and heating, as well as dramatically reduce the carbon footprint of buildings of all sizes. "Solutions to our energy crisis do not come only from using renewables; smarter technology that eliminates energy waste is absolutely vital." Smart glass windows are about 70 per cent more energy efficient during summer and 45 per cent more efficient in the winter compared to standard dual-pane glass. New York's Empire State Building reported energy savings of US$2.4 million and cut carbon emissions by 4,000 metric tonnes after installing smart glass windows. This was using a less effective form of technology. "The Empire State Building used glass that still required some energy to operate," Bhaskaran said. "Our coating doesn't require energy and responds directly to changes in temperature." Co-researcher and PhD student Mohammad Taha said that while the coating reacts to temperature it can also be overridden with a simple switch. "This switch is similar to a dimmer and can be used to control the level of transparency on the window and therefore the intensity of lighting in a room," Taha said. "This means users have total freedom to operate the smart windows on-demand." Windows aren't the only clear winners when it comes to the new coating. The technology can also be used to control non-harmful radiation that can penetrate plastics and fabrics. This could be applied to medical imaging and security scans. Bhaskaran said that the team was looking to roll the technology out as soon as possible. "The materials and technology are readily scalable to large area surfaces, with the underlying technology filed as a patent in Australia and the US," she said. The research has been carried out at RMIT University's state-of-the-art Micro Nano Research Facility with colleagues at the University of Adelaide and supported by the Australian Research Council. Their findings have been published in Scientific Reports - Nature: http://dx.doi.org/doi:10.1038/s41598-017-17937-3

How the coating works

The self-regulating coating is created using a material called vanadium dioxide. The coating is 50-150 nanometres in thickness. At 67 degrees Celsius, vanadium dioxide transforms from being an insulator into a metal, allowing the coating to turn into a versatile optoelectronic material controlled by and sensitive to light. The coating stays transparent and clear to the human eye but goes opaque to infra-red solar radiation, which humans cannot see and is what causes sun-induced heating. Until now, it has been impossible to use vanadium dioxide on surfaces of various sizes because the placement of the coating requires the creation of specialised

layers, or platforms. The RMIT researchers have developed a way to create and deposit the ultra-thin coating without the need for these special platforms - meaning it can be directly applied to surfaces like glass windows.

EurekAlert, 25 February 2018

http://www.eurekalert.org

Commentary: FDA statement on BPA's safety is both premature and ignores contradictory findings

2018-03-06

Deriving policy recommendations from unpublished data that has not yet been peer reviewed is problematic. Recently, the National Toxicology Program (NTP) released part of a multi-year study designed to resolve debate over the safety of BPA. Following the release of these partial data, the United States Food and Drug Administration (FDA) issued a statement characterising the results as showing "minimal effects" from exposure to BPA, leading many to conclude that BPA is safe at current levels. We believe however, such conclusions are being drawn prematurely and without sufficient scientific evidence to support them. The Consortium Linking Academic and Regulatory Insights on Bisphenol A Toxicity (CLARITY-BPA) study includes two separate investigations. The first (the FDA/NTP) relied on standard toxicology testing guidelines. This portion of the study – the one that has been released—is referred to as the core study. The second portion of the study includes analyses undertaken by a consortium of 14 scientific groups (C14) following proposals peer-reviewed by the National Institute of Environmental Health Sciences (NIEHS). This portion of the study is still underway. Why two parts to the investigation? Because the debate over BPA's safety revolves around which methods of investigation are used and what is being measured. The FDA has traditionally relied upon studies that use decades-old 'standardised' ("guideline") tests for effects that focus on changes in organ weight, growth parameters and tumour development. We believe such tests fail to detect many of the adverse effects shown to be caused by exposure to very small amounts of BPA, similar to those most Americans experience on a daily basis. The core study relies solely upon these standardised measures. While we concur with the need to focus on tumour development, the other standardised end points in the core study are neither sensitive enough nor specific for effects such as endocrine disruption, which is caused by BPA. The C14 work, instead, uses state-of-the-art analyses that are designed to reveal effects that relate directly to human health conditions and to diseases

that have been increasing rapidly in recent decades. This portion of the CLARITY-BPA study has yet to be completed. For both investigations, the FDA facility treated thousands of rats—under Good Laboratory Practice guidelines—with different doses of BPA over varying periods of time. Both groups received tissues from rats treated at the FDA facility. To avoid bias in data interpretation, the C14 investigators were told which animals received which treatment only once tests were complete. The C14 investigators are specialists across a broad spectrum of organs and diseases and each team applied sophisticated organ, cellular and molecular analysis to provide state-of-the-art assessments of BPA effects.

Recently, the NTP released the preliminary report of the FDA/NTP's study results, i.e. half of the CLARITY-BPA findings. We find the FDA's response to this new information from experiments with rats perplexing, given that it represents only half the data, which have not yet been peer-reviewed. We do not believe that the CLARITY-BPA results to date, including the study results just released, justify the FDA's current judgment that, according to Deputy Commissioner Stephen Ostroff, "currently authorized uses of BPA continue to be safe for consumers." First, some work by our colleagues in CLARITY-BPA has already been published in the peer-reviewed literature. They find that the lowest dose of BPA used by the FDA—the dose chosen to model real human exposure levels—caused changes in brain structure, ovarian function and cardiac health. Higher BPA doses led to learning and memory deficits. These results are consistent with findings from epidemiological studies of people. Additional data by these research teams will be released during the next year that document additional adverse effects of BPA at low doses. Second, a careful assessment of the data just released reveals adverse effects with real health implications for people: the same very low doses that produced adverse effects in the academic labs, caused increased rates of mammary gland cancer and chronic prostatitis, a potential precursor to prostate cancer, as well as other adverse effects. The FDA stated only that the mammary tumours will require further studies. It is unclear why increased mammary cancer and chronic inflammation of the prostate, at doses to which many Americans are exposed, were considered "minimal effects" of BPA. For example, a study conducted as part of CLARITY and already published in the scientific literature by one of our colleagues found that the brains of BPA-treated rats were altered by a dose of BPA at least 100,000 times lower than the dose of BPA that changed the weight of the uterus. Changes in uterine weight is one of the standardized tests deemed important by the FDA. Notably, the FDA standardized tests don't examine brain structures. Not all of the C14 scientists have published their results yet. More confirmed

consequences of low dose exposures are certainly coming. Only time will tell which is the most sensitive measurement of BPA exposure, but it is already clear that it won't be organ weight and standard histology. Deriving policy recommendations from unpublished data that has not yet been peer reviewed is problematic. More than a thousand studies by independent investigators have found that BPA drives adverse effects in laboratory experiments; these results are consistent with patterns seen in people. These most recent data indicate there is no safe level of exposure to BPA; adverse effects were found at the lowest level examined by CLARITY-BPA, by both the FDA/NTP group and the C14 investigators. From what is already known about BPA, combined with the new data that is emerging, we disagree strongly with the FDA's conclusion. In fact, we believe that the scientific evidence supports reducing exposure to BPA dramatically—an action already taken in several other industrialised countries. The authors are investigators in the CLARITY-BPA study. Frederick S. vom Saal is a Curators' Distinguished Professor in the Division of Biological Sciences at University of Missouri-Columbia; Jodi Flaws is a professor and interim head in the Department of Comparative Biosciences at the University of Illinois; Ana M. Soto, is a professor in the Department of Immunology at Tufts University School of Medicine; and Gail S. Prins is a professor in the Department of Urology, College of Medicine at the University of Illinois at Chicago.

CLARITY-BPA is a collaboration between the National Toxicology Program (NTP), National Institutes of Health (NIH), the Centre for Food Safety and Applied Nutrition (CFSAN) of the Food and Drug Administration (FDA), and 14 teams of scientists at some of the world's leading universities with expertise in relevant research specialties.

Environmental Health News, 4 March 2018

http://www.environmentalhealthnews.org/

This Start-up Grows Diamonds In A Lab That Are Just Like The Real Thing

2018-03-06

West Coast start-up Diamond Foundry is ushering in a new precious-mineral rush in California—this time for clear, undetectably lab-grown diamonds made by plasma reactor technology that mimics the outer core of the sun. When founder and CEO Martin Roscheisen had trouble getting his solar-panel company off the ground, he refitted its technology into the five-year-old Diamond Foundry, which produces 100,000 carats a year in

West Coast start-up Diamond Foundry is ushering in a new precious-mineral rush in California—this time for clear, undetectably lab-grown diamonds made by plasma reactor technology that mimics the outer core of the sun.

its new South San Francisco facility and had around $100 million in sales last year. The company's raw products are sold wholesale to jewellers around the world and used in-house for its direct-to-consumer jewellery brand, Vrai & Oro, which Diamond Foundry acquired in November 2016. Geared toward millennial women, with unique cuts, a 121,000-follower-strong Instagram presence, and ethical sourcing (no blood diamonds!), Vrai & Oro accounted for 50% of Diamond Foundry's 2017 revenue. "We're fully integrated, from mine to finger," says Roscheisen. To create an even bigger market for man-made diamonds, the company is now wooing the fashion class: It showcased its jewels at Paris Fashion Week last fall, at an event co-hosted by Stella McCartney, and has partnered with such upscale brands as Barneys New York and Swarovski for new collections. (It also helps to have Leonardo DiCaprio among its investors.) Demand is growing. "We're doubling our production over the next few months," says Roscheisen, "and we've still had to decline [sales opportunities]." Later this year, when the company debuts a megafactory in Wenatchee, Washington, customers will have another 1 million carats' worth of opportunities to buy from Diamond Foundry.

Fast Company, 3 March 2018

http://www.fastcompany.com/

Stanford sues HP companies, Agilent over toxic contamination

2018-03-06

Lawsuit alleges millions of dollars in damages for hazardous PCB, TCE discharges

Stanford University officials have filed a federal lawsuit against Hewlett-Packard Company and its successors Hewlett Packard Enterprise, HP Inc., and Agilent Technologies for years of contamination of its property with hazardous PCBs and TCE, according to court documents filed in U.S. District Court, Northern District of California, in San Jose. The board of trustees of the Leland Stanford Junior University filed the multimillion-dollar lawsuit, which does not specify a dollar amount, on 23 February. It alleges that Hewlett-Packard Company contaminated Stanford's property at 1601 S. California Ave. over a nearly 30-year period beginning in 1970. Hewlett-Packard Company, which occupied the property from 1970-1999, allegedly caused polychlorinated biphenyls (PCBs) and trichloroethylene (TCE) to be discharged over the property. It further spread PCBs over substantial portions of the property during a 1987 grading and construction project, the lawsuit claims. Stanford discovered the contamination in 2015 when it began construction of its University Terrace faculty-housing project. The university halted development

while it cleaned up the hazardous soil and developed a plan to shield its new multimillion-dollar homes from vapours emanating from the soil's remaining TCE, which could not be effectively removed. Stanford spent millions of dollars on clean-up and remediation to make the site safe for housing and had to obtain a finding from the state Department of Toxic Substances Control that there is no significant risk to future residents after it added the remediation, the lawsuit noted. TCE vapours have also been identified under some homes in the adjacent College Terrace neighbourhood, some residents found after hiring their own consultant. That issue is not mentioned in the lawsuit. Stanford is suing under the 1986 Superfund law's Section 107 (a) of the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S. Code Section 9607. The law imposes strict liability without regard to fault on entities and persons who operated a facility at the time hazardous materials were discharged or who through a contract or other agreement arranged for the disposal, treatment or transportation of hazardous materials at a facility. The university can recover costs for clean-up and its responses to the contamination. Stanford claims damages for a continuing nuisance and for costs of abating the nuisance, which have interfered with its use of the property. The presence of the hazardous materials constitutes a "continuing trespass" because it is a wrongful occupation of the property, the university claims. Stanford is seeking to recover the value of the use of the land for a three-year period and reasonable cost for the restoration of the property to its original condition. Agilent, HP Inc. and Hewlett Packard Enterprise Company are defendants because they are corporate successors of Hewlett-Packard Company and assume all assets and liabilities, including for the contamination, the university claims. Hewlett-Packard Company assigned the lease to Agilent, which was then an affiliate, from 1999-2005. The lawsuit alleges that Agilent agreed to indemnify HP and to take sole responsibility for responding to Stanford for conditions on the property, including contamination. HP spokeswoman Dana Lengkeek said that Agilent is handling the defence of the lawsuit and referred queries to Agilent. Stephanie Notaney, an Agilent spokeswoman, said the company has a strict policy prohibiting discussions or comments regarding potential litigation.

Palo Alto Online, 1 March 2018

https://www.paloaltoonline.com

Gossip

Mapping nanoscale chemical reactions inside batteries in 3-D

2018-03-06

Researchers from the University of Illinois at Chicago and Lawrence Berkeley National Laboratory have developed a new technique that lets them pinpoint the location of chemical reactions happening inside lithium-ion batteries in three dimensions at the nanoscale level. Their results are published in the journal Nature Communications. "Knowing the precise locations of chemical reactions within individual nanoparticles that are participating in those reactions helps us to identify how a battery operates and uncover how the battery might be optimised to make it work even better," said Jordi Cabana, associate professor of chemistry at UIC and co-corresponding author on the paper. As a battery charges and discharges, its electrodes -- the materials where the reactions that produce energy take place -- are alternately oxidized and reduced. The chemical pathways by which these reactions take place help determine how quickly a battery becomes depleted. Tools available to study these reactions can only provide information on the average composition of electrodes at any given point in time. For example, they can let a researcher know what percentage of the electrode has become permanently oxidized. But these tools cannot provide information on the location of oxidized portions in the electrode. Because of these limitations, it is not possible to tell if reactions are confined to a certain area of the electrode, such as the surface of the material, or if reactions are taking place uniformly throughout the electrode. "Being able to tell if there is a tendency for a reaction to take place in a specific part of the electrode, and better yet, the location of reactions within individual nanoparticles in the electrode, would be extremely useful because then you could understand how those localised reactions correlate with the behaviour of the battery, such as its charging time or the number of recharge cycles it can undergo efficiently," Cabana said. The new technique, called X-ray ptychographic tomography, came about through a partnership between chemists at UIC and scientists at the Advanced Light Source, at Lawrence Berkeley National Laboratory in California. Advanced Light Source scientists developed the instrumentation and measurement algorithms, which were used to help answer fundamental questions about battery materials and behaviour identified by the UIC team. Together, the two teams used the tomographic technique to look at tens of nanoparticles of lithium-iron phosphate recovered from a battery electrode that had been partially charged. The researchers used a coherent, nanoscale beam of X-rays generated by the high-flux synchrotron accelerator at the Advanced Light Source to

Researchers from the University of Illinois at Chicago and Lawrence Berkeley National Laboratory have developed a new technique that lets them pinpoint the location of chemical reactions happening inside lithium-ion batteries in three dimensions at the nanoscale level.

interrogate each nanoparticle. The pattern of absorption of the beam by the material gave the researchers information about the oxidation state of iron in the nanoparticles in the X-ray beam. Because they were able to move the beam just a few nanometres over and run their interrogation again, the team could reconstruct chemical maps of the nanoparticles with a resolution of about 11 nanometres. By rotating the material in space, they could create a three-dimensional tomographic reconstruction of the oxidation states of each nanoparticle. In other words, they could tell the extent to which an individual nanoparticle of lithium iron phosphate had reacted. "Using our new technique, we could not only see that individual nanoparticles showed different extents of reaction at a given time, but also how the reaction worked its way through the interior of each nanoparticle," Cabana said.

EurekAlert, 2 March 2018

http://www.eurekalert.org

Simplifying samples

2018-03-06

Inexpensive, novel method to transport blood, urine samples without refrigeration developed at Washington University

Imagine a physician in a rural or remote area who needs to send a patient's blood or urine sample to a hospital hundreds of miles away for testing. To preserve the sample's quality, it must be refrigerated throughout transport, a costly process requiring tremendous energy which may be scarce. Using nanotechnology, a team of researchers at Washington University in St. Louis has eliminated the need for refrigeration by developing a new low-cost technique that creates a protective shield around protein biomarkers in the sample. With this method, the samples maintain 95 percent of their purity and the information on which important health-care decisions are based. The team is led by Srikanth Singamaneni, associate professor of mechanical engineering & materials science in the School of Engineering & Applied Science; and two scientists at Washington University School of Medicine in St. Louis: Jeremiah J. Morrissey, research professor of anaesthesiology; and Evan D. Kharasch, MD, PhD, the Russell D. and Mary B. Shelden Professor of Anaesthesiology and professor of biochemistry and molecular biophysics. They used a nanoporous material to essentially shrink wrap protein biomarkers in blood and urine samples by growing crystals around the molecules. Then, they transferred the shrink-wrapped molecules onto standard lab filter paper. Once dry, the paper can be shipped at any temperature to a lab for testing. "Once you are ready to analyse the sample, you extract everything from the paper back into liquid," Singamaneni said. "We showed that

this method maintains the integrity of the biospecimens." The research, recently published in Chemistry of Materials, is the first published work that uses an emerging class of nanomaterials known as metal-organic frameworks with biospecimens such as blood, urine, serum and plasma. This inexpensive and accessible method has wide applicability, the researchers said, with the potential to be used in developing countries with limited access to health care and electricity, in rural areas with limited resources, or at off-site clinics or screenings. More than a year ago, the team published a paper in Advanced Materials in which it grew metal-organic frameworks around antibodies attached to gold nanorods to eliminate the need for refrigeration in storing biodiagnostic chips. This method protected the antibodies for a week stored at room temperature, though required that the protective layers be rinsed off before use.
"We asked why we couldn't apply the same technology to preserve the biospecimen instead of preserving the biosensor," Singamaneni said. "The implementation required us to overcome a few critical hurdles because it's not the same as preserving something that is bound to a substrate compared to what's in a solution." To test their technique, the team used artificial urine samples spiked with neutrophil gelatinase-associated lipcalin (NGAL), a biomarker for acute kidney injury; and blood samples spiked with CA-125, a biomarker for ovarian cancer. The team mixed the samples with precursors of the nanoporous material ZIF-8 and let them dry on the paper at room temperature. Using standard bioanalytical techniques, the team determined that the samples with ZIF-8 encapsulation had more than 95 percent of NGAL preserved. The team also tested the method with urine samples from three patients with acute kidney injury. The samples stored at room temperature retained more than 90 percent of NGAL. Control samples without ZIF-8 encapsulation had less than 30 percent of NGAL preserved. Similarly, the blood samples spiked with CA-125 and encapsulated by ZIF-8 showed about 85 percent preservation, while those without the encapsulation showed 50 percent or less preservation. To test the method in a real-world application, the researchers put the paper with the dried samples in a standard envelope and sent them via regular mail to a colleague in California, who mailed them back to Washington University. The researchers tested the samples after the 10-day round trip and found up to 90 percent of the NGAL was preserved. The team plans to test the method with other biomolecules to create more potential applications for both research and clinical settings, as well as to develop a biopreservation kit that would allow patients to prepare their own dried blood or urine samples to send to labs for testing. To ensure that this method gets to resource-limited settings, the team has worked with the university's Office of Technology Management to

patent the technology and plans to develop it into a product available to the health-care industry. Ultimately, they envision a biopreservation kit that would include the ZIF-8 precursors, paper strips and other materials needed to allow patients in underserved areas to prepare their own blood and urine samples and send them to hospitals or labs. "One of our next steps is to take the technology out of the laboratory and commercialise it so that it can work to the greatest good for the greatest number of people," said Kharasch, also director of the Centre for Clinical Pharmacology. "This would make it widely available in both first-world countries as well as emerging countries and in emergency situations or environmental disasters where we need to deploy people and have scarce resources."

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http://www.eurekalert.org

Mining hardware helps scientists gain insight into silicon nanoparticles

2018-03-06

Researchers first developed a three-dimensional dynamic model of an interaction between light and nanoparticles.

Researchers first developed a three-dimensional dynamic model of an interaction between light and nanoparticles. They used a supercomputer with graphic accelerators for calculations. Results showed that silicon particles exposed to short intense laser pulses lose their symmetry temporarily. Their optical properties become strongly heterogeneous. Such a change in properties depends on particle size, therefore it can be used for light control in ultrafast information processing nanoscale devices. The study is published in Advanced Optical Materials.

Improvement of computing devices today requires further acceleration of information processing. Nanophotonics is one of the disciplines that can solve this problem by means of optical devices. Although optical signals can be transmitted and processed much faster than electronic ones, first, it is necessary to learn how to quickly control light on a small scale. For this purpose, one could use metal particles. They localise light efficiently, yet weaken the signal eventually causing significant losses. However, dielectric and semiconducting materials, such as silicon, can be used instead of metal. Silicon nanoparticles are now actively studied by researchers all around the world, including ITMO University. The long-term goal of such studies is to create an ultrafast compact modulator for optical signal. They can serve as a basis for computers of the future. However, this technology will become feasible only once we understand how nanoparticles interact with light. "When a laser pulse hits the particle, a lot of free electrons are formed inside," explains Sergey Makarov, head

of the Laboratory of Hybrid Nanophotonics and Optoelectronics of ITMO University. "As a result, a region saturated with oppositely charged particles is created. It is usually called an electron-hole plasma. Plasma changes optical properties of particles and up to now everybody believed that it happens with the whole particle simultaneously, so that the symmetry is preserved. We showed that this is not entirely true and an even distribution of the plasma inside particles is not the only possible scenario." Scientists found that an electromagnetic disturbance caused by interaction between light and particles has a more complex structure. This leads to a light distortion, varying with time. Therefore, the symmetry of particles breaks and optical properties become different throughout one particle. "Using analytical and numerical methods we first looked inside the particle and saw that processes taking place there are far more complicated than we thought," says Konstantin Ladutenko, a member of the International Research Centre of Nanophotonics and Metamaterials of ITMO University. "Moreover, we found that by changing the particle size, we can affect its interaction with the light signal. So, we might be able to predict the signal path in an entire system of nanoparticles." In order to create a tool to study processes inside nanoparticles, scientists from ITMO University joined forces with colleagues from Jean Monnet University in France. "We proposed analytical methods to determine particle size and refractive index, which might provide a change in optical properties. Afterwards, with powerful computational methods we tracked processes inside particles. Our colleagues did calculations on a computer with graphics accelerators. Such computers are often used for cryptocurrency mining. However, we decided to enrich humanity with new knowledge, rather than enrich ourselves. What is more, bitcoin rate just started to fall then," adds Konstantin. Devices based on such nanoparticles may become basic elements of optical computers, just as transistors now are basic elements of electronics. They will make it possible to distribute and redirect or branch the signal. "Such asymmetric structures have a variety of applications yet we focus on ultra-fast signal processing," continues Sergey. "Now we have a powerful theoretical tool which will help us to develop a quick and compact light management system."

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Gossip

Common bricks can be used to detect past presence of uranium, plutonium

2018-03-06

Researchers from North Carolina State University have demonstrated a technique that can determine whether bricks - the common building material - have ever been near a radiological source, and identify the specific type of source, such as high enriched uranium or plutonium. The technique is possible when there are no chemical residues left behind and has security and nuclear non-proliferation applications. Robert Hayes, an associate professor of nuclear engineering at NC State and co-author of a paper on this work, previously used simulations to demonstrate the concept that building materials could be used to characterize nuclear material - even after it was no longer there. But the NC State team has now validated that the technique works for characterising transuranic radioactive materials and fine-tuned the technique so that it can be done in days instead of weeks. "The technique laid out in our paper can take brick samples the size of a thimble and use them to identify whether a radiological source was plutonium, uranium, and so on, even if the source has been removed," says Ryan O'Mara, a Ph.D. student at NC State and first author of the paper. "That has clear non-proliferation applications. For example, if a facility says that it has not been making high-enriched uranium - the kind used in weapons - you could take a sample from the building itself and determine whether there had been high-enriched uranium on site." Researchers envision a variety of future applications as well. The researchers think the technique may also be used to determine whether nuclear facilities are shipping out as many spent "low burnup" fuel rods as they say they are. This is significant because some facilities have secretly diverted a percentage of their low burnup fuel rods for use as feedstock that can be used to create weapons-grade plutonium. "We're submitting proposals to support that work, as well as work that could help us better assess public exposure in the event of a radiological incident - which would have real value in the context of emergency response," Hayes says. "And we are already working to demonstrate that we can use the technique as a three-dimensional 'gamma camera,' giving us the ability to capture the dimensions of the source or sources."

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http://www.eurekalert.org

Researchers from North Carolina State University have demonstrated a technique that can determine whether bricks - the common building material - have ever been near a radiological source, and identify the specific type of source, such as high enriched uranium or plutonium.

Gossip

New dual-atom catalyst shows promise to yield clean energy by artificial photosynthesis

2018-03-06

Looking for new solutions to more efficiently harvest and store solar energy, scientists from the U.S. and China have synthesized a new, dual-atom catalyst to serve as a platform for artificial photosynthesis, the team reported in the Proceedings of the National Academy of Sciences. The team developed an iridium catalyst with only two active metal centres. Most significantly, experiments revealed the catalyst to be a well-defined structure, capable of serving as a productive platform for future research on solar fuel synthesis. "Our research concerns the technology for direct solar energy storage," said Boston College Associate Professor of Chemistry Dunwei Wang, a lead author of the report. "It addresses the critical challenge that solar energy is intermittent. It does so by directly harvesting solar energy and storing the energy in chemical bonds, similar to how photosynthesis is performed but with higher efficiencies and lower cost." Researchers have spent considerable time on single-atom catalysts (SACs) and rarely explored an "atomically dispersed catalyst" featuring two atoms. In a paper titled "Stable iridium dinuclear heterogeneous catalysts supported on metal-oxide substrate for solar water oxidation," the team reports synthesizing an iridium dinuclear heterogeneous catalyst in a facile photochemical way. The catalyst shows outstanding stability and high activity toward water oxidation, an essential process in natural and artificial photosynthesis. Researchers focused on this aspect of catalysis encounter particular challenges in the development of heterogeneous catalysts, which are widely used in large-scale industrial chemical transformations. Most active heterogeneous catalysts are often poorly defined in their atomic structures, which makes it difficult to evaluate the detailed mechanisms at the molecular level. The team was able to take advantage of new techniques in the evaluation of single-atom catalysts and develop a material platform to study important and complex reactions that would require more than one active site. Wang said the team of researchers set out to determine "what the smallest active and most durable heterogeneous catalyst unit for water oxidation could be. Previously, researchers have asked this question and found the answer only in homogeneous catalysts, whose durability was poor. For the first time, we have a glimpse of the potential of heterogeneous catalysts in clean energy production and storage." The team also performed X-ray experiments at Lawrence Berkeley National Laboratory's Advanced Light Source that helped to determine the structure of the iridium catalyst. They used two techniques: X-ray absorption fine structure (EXAFS) and

A structural characterisation of a new iridium dinuclear heterogeneous catalyst reveals bright pairs of atoms. The new catalyst is regarded as an advance in efforts to produce and store clean energy through artificial photosynthesis.

X-ray Absorption Near Edge Structure (XANES) in their measurements. These experiments provide critical evidence to better understand the new catalyst. Wang said the team was surprised by the simplicity and durability of the catalyst, combined with the high activity toward the desired reaction of water oxidation. Wang said the next steps in the research include further optimisation of the catalyst for practical use and an examination of areas where the catalyst can be applied to new chemical transformations.

Phys.org, 5 March 2018

http://phys.org

FlatScope: Team designs lens-free fluorescent microscope

2018-03-06

FlatScope is being developed at Rice University for use as a fluorescent microscope able to capture three-dimensional data and produce images from anywhere within the field of view.

Lenses are no longer necessary for some microscopes, according to Rice University engineers developing FlatScope, a thin fluorescent microscope whose abilities promise to surpass those of old-school devices. A paper in Science Advances by Rice engineers Ashok Veeraraghavan, Jacob Robinson, Richard Baraniuk and their labs describes a wide-field microscope thinner than a credit card, small enough to sit on a fingertip and capable of micrometre resolution over a volume of several cubic millimetres. FlatScope eliminates the trade-off that hinders traditional microscopes in which arrays of lenses can either gather less light from a large field of view or gather more light from a smaller field. The Rice team began developing the device as part of a federal initiative by the Defence Advanced Research Projects Agency as an implantable, high-resolution neural interface. But the device's potential is much greater. The researchers claim FlatScope, an advance on the labs' earlier FlatCam, could be used as an implantable endoscope, a large-area imager or a flexible microscope. "We think of this as amping up FlatCam so it can solve even bigger problems," Baraniuk said. Traditional fluorescent microscopes are essential tools in biology. They pick up fluorescent signals from particles inserted into cells and tissues that are illuminated with specific wavelengths of light. The technique allows scientists to probe and track biological agents with nanometre-scale resolution. But like all traditional microscopes, telescopes and cameras, their resolution depends on the size of their lenses, which can be large and heavy and limit their use in biological applications. The Rice team takes a different approach. It uses the same charge-coupled device (CCD) chips found in all electronic cameras to capture incoming light, but the comparisons stop there. Like

the FlatCam project that inspired it, FlatScope's field of view equals the size of the CCD sensor, which can be as large or as small as required. It's flat because it replaces the array of lenses in a traditional microscope with a custom amplitude mask. This mask, which resembles a bar code, sits directly in front of the CCD. Light that comes through the mask and hits the sensor becomes data that a computer program interprets to produce images. The algorithm can focus on any part of the three-dimensional data the scope captures and produce images of objects smaller than a micron anywhere in the field. That resolution is what makes the device a microscope, Robinson said. "A camera in your mobile phone or DSLR typically gets on the order of 100-micron resolution," he said. "When you take a macro photo, the resolution is about 20 to 50 microns. "I think of a microscope as something that allows you to image things on the micron scale," he said. "That means things that are smaller than the diameter of a human hair, like cells, parts of cells or the fine structure of fibres." Achieving that resolution required modifications to the FlatCam mask to further cut the amount of light that reaches the sensor as well as a rewrite of their software, Robinson said. "It wasn't as trivial as simply applying the FlatCam algorithm to the same techniques we used to image things that are far away," he said. The mask is akin to the aperture in a lensed camera that focuses light onto the sensor, but it's only a few hundred micrometres from the sensor and allows only a fraction of the available light to get through, limiting the amount of data to simplify processing. "In the case of a megapixel camera, that computational problem requires a matrix of a million times a million elements," Robinson said. "It's an incredibly big matrix. But because we break it down through this pattern of rows and columns, our matrix is just 1 million elements." That cuts the data for each snapshot from six terabytes to a more practical 21 megabytes, which translates to short processing times. From early versions of FlatCam that required an hour or more to process an image, FlatScope captures 30 frames of 3-D data per second. Veeraraghavan said the burgeoning internet of things may provide many applications for flat cameras and microscopes. That in turn would drive down costs. "One of the big advantages of this technology compared with traditional cameras is that because we don't need lenses, we don't need post-fabrication assembly," he said. "We can imagine this rolling off a fabrication line." But their primary targets are medical uses, from implantable scopes for the clinic to palm-sized microscopes for the battlefield. "To be able to carry a microscope in your pocket is a neat technology," Veeraraghavan said. The researchers noted that while their current work is focused on fluorescent applications, FlatScope could also be used for bright-field, dark-field and reflected-

light microscopy. They suggested an array of FlatScopes on a flexible background could be used to match the contours of a target.

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http://phys.org

Physicists show interactions between smoke and clouds have unexpected cooling effect

2018-03-06

Atmospheric physicists have found that the way wildfire smoke from Africa interacts with clouds over the Atlantic Ocean results in a net cooling effect, which is contrary to previous understanding and has implications for global climate models. Clouds play a prominent role in moderating Earth's climate, but their role is still poorly understood. Generally, clouds cool the Earth by reflecting incoming sunlight back out into space. Reducing the clouds' reflectivity—with a layer of pollution, for example—reduces the cooling effect. However, new research in Proceedings of the National Academy of Sciences by physicists at UMBC and collaborators adds a surprising twist to this model. Every fall, fires race across central and southern Africa, creating so much smoke that it's clearly visible from space. Wind sweeps the smoke westward over the Atlantic Ocean, where it rises above the largest semi-permanent gathering of clouds in the world. For years, scientists believed that overall, the smoke diminishes the clouds' cooling effect by absorbing light that the clouds beneath otherwise would reflect. The new study by Zhang and colleagues doesn't dispute this effect but introduces a new mechanism that counteracts it by making the clouds more reflective. "The purpose of this paper is to look at these competing processes. Which one is more important?" asks Zhang. Using data from a LiDAR system on the International Space Station, recent UMBC research found that the smoke and cloud layers are much closer to each other than previously observed. That means the smoke, which is in the form of tiny particles known as aerosols, can physically interact with the clouds, affecting how they form at the microscopic level. Previous studies usually overlooked these microphysical changes due to aerosols' interactions with the clouds. Clouds need "seeds" to grow. A seed can be any tiny particle around which cloud droplets condense. Aerosols are perfect for seeding clouds, and with more seeds, many small cloud droplets replace fewer large droplets, which then collectively reflect more light and increase the cooling effect. The team found that in smoky conditions, there are almost twice as many "seeds" per cubic centimetre. By running computer simulations under different conditions, they determined that overall,

Atmospheric physicists have found that the way wildfire smoke from Africa interacts with clouds over the Atlantic Ocean results in a net cooling effect, which is contrary to previous understanding and has implications for global climate models.

Gossip

"The seeding effect is winning," Zhang says. So, contrary to long-held understanding, the overall effect of the hovering smoke on the clouds near Africa appears to be a cooling one. Zhang is quick to point out that this result is not an argument in favour of fires. "Aerosols are a very local phenomenon, and they are also short-lived," he says, so their cooling effects are short-lived, too. "The lifetime of carbon dioxide and other greenhouse gases," which are released in abundance when plant material burns, "is hundreds of years." The team's ultimate goal is to refine global climate models by improving how they account for clouds. Zhang's other Ph.D. student and another co-author, Zhifeng Yang, has contributed to that effort by analysing data collected by a satellite that stays put in the sky (rather than orbiting Earth) to get a more accurate sense of how cloud cover changes in daily cycles. The next step is to evaluate existing climate models against the team's new finding. "Now that we know there are two competing mechanisms, and the seeding effect is winning, we can see whether climate models consider these processes properly when they predict the weather and climate in this area," explains Zhang. A new NASA mission called PACE expected to launch in 2020 will aid their efforts. It will be able to detect polarised light, in addition to everything LiDAR can do. "With the new satellite you can look at things from different perspectives," says Zhang, and develop three-dimensional models of the interactions between aerosols and clouds. "Hopefully we can look at this phenomenon even better." Beyond the upcoming NASA mission, what really excites Zhang and his team is the opportunity to play a role in making sure communities around the world have the best information available as they prepare for the effects of climate change.

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http://phys.org

Researchers convert CO to CO2 with a single metal atom

2018-03-06

Tufts University researcher Charles Sykes has demonstrated for the first time that a single metal atom can act as a catalyst in converting carbon monoxide into carbon dioxide, a chemical reaction that is commonly used in catalytic converters to remove harmful gases from car exhaust.

Researchers from Washington State University and Tufts University have demonstrated for the first time that a single metal atom can act as a catalyst in converting carbon monoxide into carbon dioxide, a chemical reaction that is commonly used in catalytic converters to remove harmful gases from car exhaust. The research, published in the journal Nature Catalysis, could improve catalytic converter design and also has major implications in the field of computational catalysis.

Overcoming lower engine temperatures

Gossip

As engines have become more efficient, their combustion temperature has become lower, making it harder for catalytic converters to work and creating, paradoxically, more harmful emissions. Car companies have struggled to meet strict emissions standards that aim to protect human health. Volkswagen was even found guilty of having developed a software workaround to cheat on emissions testing. While studying low-temperature catalysts, the researchers, led by Jean-Sabin McEwen, assistant professor in WSU's Voiland School of Chemical Engineering and Bioengineering, and Charles Sykes, a professor of chemistry at Tufts University, got interested in single metal atoms and their ability to act as catalysts at lower temperatures. "Most of the harmful chemicals in your exhaust such as carbon monoxide and nitrogen oxide are emitted when starting up the engine," said McEwen. "The lower the temperature, the harder it is to neutralize these harmful chemicals."

Carbon monoxide to carbon dioxide

In their paper, the researchers demonstrated that the reaction can work with single platinum atoms on a copper oxide support near room temperature. The single platinum atom holds the carbon monoxide in place while the copper oxide supplies the oxygen to convert it into carbon dioxide. "This is a benchmark study that can guide the design of the next generation of low temperature catalytic converters," said Sykes. Since catalytic converters use rare and expensive metals like platinum, reducing the use of those elements down to the single atom level could also reduce costs, he added. Their research also conclusively answers a longstanding debate in the scientific world on whether a single metal atom could act as a catalyst for the oxidation of carbon monoxide to carbon dioxide at low temperatures or whether such a reaction requires a cluster of atoms.

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http://phys.org

Researchers in Oregon State University's College of Engineering have taken a key step toward the rapid manufacture of flexible computer screens and other stretchable electronic devices, including soft robots.

Modified, 3D-printable alloy shows promise for flexible electronics, soft robots

2018-03-06

Researchers in Oregon State University's College of Engineering have taken a key step toward the rapid manufacture of flexible computer screens and other stretchable electronic devices, including soft robots. The advance by a team within the college's Collaborative Robotics and Intelligent Systems Institute paves the way toward the 3D printing of tall,

complicated structures with a highly conductive gallium alloy. Researchers put nickel nanoparticles into the liquid metal, galinstan, to thicken it into a paste with a consistency suitable for additive manufacturing. "The runny alloy was impossible to layer into tall structures," said Yiit Mengüç, assistant professor of mechanical engineering and co-corresponding author on the study. "With the paste-like texture, it can be layered while maintaining its capacity to flow, and to stretch inside of rubber tubes. We demonstrated the potential of our discovery by 3D printing a very stretchy two-layered circuit whose layers weave in and out of each other without touching." Findings were recently published in Advanced Materials Technologies. Gallium alloys are already being used as the conductive material in flexible electronics; the alloys have low toxicity and good conductivity, plus they're inexpensive and "self-healing" - able to attach back together at break points. But prior to the modification developed at OSU, which used sonication - the energy of sound - to mix the nickel particles and the oxidized gallium into the liquid metal, the alloys' printability was restricted to 2-dimensional. For this study, researchers printed structures up to 10 millimetres high and 20 millimetres wide. "Liquid metal printing is integral to the flexible electronics field," said co-author Doan Yirmibeolu, a robotics Ph.D. student at OSU. "Additive manufacturing enables fast fabrication of intricate designs and circuitry." The field features a range of products including electrically conductive textiles; bendable displays; sensors for torque, pressure and other types of strain; wearable sensor suits, such as those used in the development of video games; antennae; and biomedical sensors. "The future is very bright," Yirmibeolu said. "It's easy to imagine making soft robots that are ready for operation, that will just walk out of the printer." The gallium alloy paste demonstrates several features new to the field of flexible electronics, added co-corresponding author Uranbileg Daalkhaijav, Ph.D. candidate in chemical engineering. "It can be made easily and quickly," Daalkhaijav said. "The structural change is permanent, the electrical properties of the paste are comparable to pure liquid metal, and the paste retains self-healing characteristics." Future work will explore the exact structure of the paste, how the nickel particles are stabilized, and how the structure changes as the paste ages.

Tech Xplore, 5 March 2018

https://techxplore.com/

Spectroscopy insights could lead to an inexpensive route to an industrial oxidiser

Gossip

Watching palladium directly synthesize hydrogen peroxide

2018-03-06

By scrutinising a nanoparticle catalyst while it converts hydrogen and oxygen to hydrogen peroxide, researchers have uncovered new information about the mechanism that drives the process, providing insights that could lead to the design of industrial catalysts capable of making the peroxide inexpensively (ACS Catal. 2018, DOI: 10.1021/acscatal.7b03514). H2O2 is used commercially for bleaching and as a disinfectant and oxidiser. Worldwide production is projected to exceed 5.5 million tons by 2022, according to Global Industry Analysts. Manufacturers prepare the peroxide from anthraquinone via an energy-intensive, multistep process. Synthesising the compound directly from hydrogen and oxygen gases could require less energy, but the route is difficult because water is the thermodynamically favoured product. Various research groups have come up with nanoparticle-based catalytic and electrocatalytic direct-synthesis methods, but in general, those methods suffer from problems with catalyst stability and product selectivity. Nanoparticle catalysts often undergo structural changes inside reactors, forming active sites on the fly. Identifying those changes can lead to useful insights for tweaking catalyst design, but making such observations is notoriously difficult. Scientists at the Karlsruhe Institute of Technology set out to find a way to watch a palladium catalyst make H2O2. Led by Manuel Selinsek and Dmitry E. Doronkin, the researchers designed a reactor cell that enabled them to use X-ray absorption spectroscopy to monitor a nanoparticle catalyst—palladium on titanium dioxide—as it mediated reactions. They filled the room-temperature cell with water and pressurized it to 9.8 atm with hydrogen and oxygen at various ratios. They found that even before pressurising the cell, residual oxygen dissolved in water adsorbed on the metal particle surfaces. As they raised the pressure, the gases formed hydrogen peroxide, but only when the H2-to-O2 ratio was between 0.5 and 2.0. X-ray analysis showed that at those ratios, hydrogen converted metallic palladium to α-palladium hydride, a catalytically active form in which hydrogen burrows into the palladium lattice. H2O2 formed when lattice hydrogens reacted with surface oxygens. Raising the H2-to-O2 ratio above 2.0 converted α-palladium hydride to the β form of the hydride. Under those conditions, the system formed water, likely due to overhydrogenation of the peroxide. "This is a very interesting study as it probes the nature of a palladium catalyst under operating conditions and clearly shows the potential role of various palladium hydrides in this challenging reaction," says Graham J. Hutchings,

a catalysis specialist at Cardiff University. "The experimental setup is ingenious, but I doubt this could be scaled up," Hutchings says. Even so, he remarks that "the study will inspire others to study this reaction under actual operating conditions."

Chemical & Engineering News, 5 March 2018

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

Carbonate mineral forms diamond on its own

2018-03-06

When a meteorite slammed into Earth some 50,000 years ago, forming the bowl-shaped Xiuyan crater in northeast China, it left a treasure trove of geochemical research goodies. By applying microscopy and spectroscopy methods to analyse carbonate minerals found there, researchers have uncovered samples of diamond and a new mechanism for its formation (Proc. Natl. Acad. Sci. USA 2018, DOI: 10.1073/pnas.1720619115). Ming Chen of the Guangzhou Institute of Geochemistry, Ho-kwang Mao of the Centre for High Pressure Science & Technology Advanced Research in Shanghai, and co-workers studied the effects of the high heat and pressures generated during impact on ankerite, a carbonate mineral containing calcium, iron, and magnesium. They found that impact pressures of 25–45 GPa and temperatures of 800–900°C were sufficient to decompose ankerite and form diamond. In that process, the carbonate component underwent self-reduction, turning into diamond, as iron changed oxidation states from Fe2+ to Fe3+ and formed a high-pressure polymorph of magnesioferrite ($MgFe^{3+}_2O_4$). The transformation does not involve melting, and it represents a unique mechanism of diamond formation from carbonates in that it does not include a fluid and additional reductant. The ability of carbonate to produce diamond by itself implies that diamond could be a very common mineral in Earth's lower mantle, where carbonates are abundant and pressures and temperatures are high enough to drive this process, the researchers note.

New geological mechanism involving carbonate suggests Earth's lower mantle may be rich in diamond

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

Gossip

Hydrogen extraction breakthrough could be game-changer

2018-03-06

Precious metals are the standard catalyst material used for extracting hydrogen from water. The problem is these materials - such as platinum, ruthenium and iridium - are too costly. A team from KTH Royal Institute of Technology recently announced a breakthrough that could change the economics of a hydrogen economy. Led by Licheng Sun, professor of molecular electronics at KTH, the researchers concluded that precious metals can be replaced by a much cheaper combination of nickel, iron and copper (NiFeCu). "The new alloy can be used to split water into hydrogen," says researcher Peili Zhang. "This catalyst becomes more efficient than the technologies available today, and significantly cheaper. "This technology could enable a large-scale hydrogen production economy," he says. Hydrogen can be used for example to reduce carbon dioxide from steel production or to produce diesel and aircraft fuel.
It's not the first time a cheaper material has been proposed for water splitting, but the researchers argue that their solution is more effective than others. They published their results recently in the scientific journal Nature Communications. "The high catalytic performance of core-shell NiFeCu for water oxidation is attributed to the synergistic effect of Ni, Fe and Cu," Zhang says. Zhang says that copper plays an interesting role in the preparation of the electrode. In an aqueous solution, surface copper dissolves and leave a very porous structure to enhance the electrochemically active surface area. "The porous oxide shell with its high electrochemically active surface area is responsible for the catalytic activity, while the metallic cores work as facile electron transport highways," Zhang says.

Phys.org, 5 March 2018

http://phys.org

New digital process produces vintage looks with fewer chemicals

At Levi's, lasers wear your jeans

2018-03-06

No one wants to be caught wearing dad jeans. And so, while denim trends are always evolving, it's clear that the vintage look has legs. Now Levi Strauss & Co. has a faster and greener process to make new jeans look old. It is swapping oxidising chemicals and pumice stones for digital image files and fabric-zapping lasers. To make jeans with wear attributes like whisker patterns, worn spots, or crackle textures, Levi's designers are rolling out

digital image software for placing each detail. At the manufacturing plant, the digital file will guide a laser to embed the design. Then the garment will be rinsed as usual. The process reduces the number of chemicals needed to produce today's endless variations of worn and faded jeans, according to Levi's. It is common to finish a pair of denim jeans using pumice stones and 15 types of chemicals, including bleaches, peroxides, enzymes, acids, lubricants, wetting agents, and softeners. One finishing chemical Levi's says it plans to do away with is potassium permanganate ($KMnO_4$), a strong oxidiser. Overall, the new process will help the company reach its commitment to eliminate discharges of hazardous chemicals by 2020. In addition, using fewer chemicals in washes and rinses will help the company expand its program to recycle water at its facilities. Levi's says the digital process will greatly speed up its manufacturing. Until now, workers made wear patterns on each pair by hand. By using lasers, workers can produce a distressed-looking garment in 90 seconds versus 20 or 30 minutes. By making "just in time" jean designs, Levi's can avoid waste when tastes change. "We believe it is possible to be both agile and sustainable without compromising the authenticity our consumers expect from us," Levi's CEO Chip Bergh commented on the company's blog.

Chemical & Engineering News, 1 March 2018

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

Rechargeable battery weathers extreme cold conditions

2018-03-06

Batteries that work at super low temperatures could power devices in space and the Arctic

Rechargable batteries perform poorly when it's cold out. Now researchers have designed a new lithium-ion battery that still works at –70 °C. Such batteries could improve the performance of electric cars in winter, and help power high-altitude machinery, space stations, and planetary rovers (Joule 2018, DOI: 10.1016/j.joule.2018.01.017). On cold winter days, electric vehicles can lose half their driving range due to poor battery performance. At –40 °C, lithium-ion batteries retain just 12% of their capacity. So, in the Arctic, at high altitudes, and in space, rechargeable batteries must be insulated and heated, or non-rechargeable batteries or supercapacitors must be used instead. Lithium-ion batteries work poorly in extreme cold because their electrolyte solvents become viscous or even freeze, which hampers the movement of lithium ions between the anode and cathode during charging and use. Also, when it's cold, the ions can't make their way inside the graphite anode—a process called intercalation. Instead, the lithium ions plate the electrode's surface with flammable lithium metal. To make a rechargeable battery that would operate safely and maintain

performance in the extreme cold, Yongyao Xia, a physical chemist at Fudan University, selected ethyl acetate as a cold-tolerant electrolyte solvent. Ethyl acetate's freezing point is –84 °C, and it doesn't become viscous when it's cold. A previous paper showed that ethyl acetate could be used in a lithium-ion battery, but those researchers didn't explore its use at low temperatures. So, Xia gave it a try. But when his team combined the solvent with conventional electrodes, the battery still performed poorly at low temperatures. Xia's group next combined the solvent with electrodes made of organic materials instead of the conventional inorganic ones. When the battery charges, the polyimide anode material undergoes a reaction that allows lithium ions to bind to it, while counter anions absorb onto a polytriphenylamine cathode. When the battery discharges, the reaction goes in reverse, lithium ions get released, and the anions desorb. The resulting organic battery works from 50 °C down to –70 °C. And at –70 °C, the battery maintains 70% of its room-temperature storage capacity. Maintaining performance over such a wide temperature range is impressive, says Shirley Meng, a materials scientist at the University of California, San Diego. However, the Fudan battery works at only 1.2 V, which is a relatively low voltage, she says. Xia says his group is further tailoring the electrolyte and electrode materials to improve performance.

Chemical & Engineering News, 1 March 2018

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

Why efforts to use green fuels sometimes run afoul

2018-03-06

Some microbes thrive on biofuels and can contaminate fuel equipment and clog engines

Most people exercise a healthy dose of caution when handling fuels like gasoline and diesel. Health-wise, they know you shouldn't deeply inhale the fuels' vapours or splash the liquids on your skin. Ingesting them is out of the question. But it turns out that not everyone avoids contact with fuels: Some microbes love the stuff. In fact, various microorganisms thrive on gasoline and diesel fuel, substances that are clearly toxic to humans and animals. Unfortunately, this bug love can lead to fuel contamination, clogged or fouled equipment, and if left unchecked, even engine failure. Scientists have long known about the threat of microbial fuel fouling. But they have more cause for concern now that the popularity of biofuels, such as biodiesel, is on the rise. Some bacteria and fungi crave the generous quantities of fatty acid compounds that make up biofuels. Private motorists have little to worry about because they tend to use and replace small quantities of fuel frequently. But for airlines and other organisations that store enormous quantities of fuel, contamination

could be a problem. For the U.S. Air Force, which has a mandate to rely increasingly on biobased fuels, extreme caution is in order. That's why Wendy J. Goodson studies the effects of microorganisms on Air Force weapons systems and fuelling infrastructure. Goodson leads a research group at the Air Force Research Laboratory at Wright-Patterson Air Force Base in Ohio. Together with collaborators, these researchers are studying the effects of fuel biocontamination, the factors that promote this type of degradation, and improved ways of detecting it. They're also zeroing in on the identities and genomes of the troublemaking organisms and devising ways of stopping them in their tracks. Although people may find it surprising that some microorganisms happily eat engine fuels, it's not exactly a secret. "Biodeterioration of fuels has been known and studied for more than a century," asserts Frederick J. Passman, a consultant who specialises in controlling microbial contamination. The earliest study, which focused on biocontamination of gasoline, was published in 1895 in a German-language journal, Passman says. And most of the follow-up studies were published in the microbiology literature, "not in the sort of journals likely to be read by petroleum engineers and organic chemists," he adds. Goodson concurs. She says fuel maintenance specialists were aware that fuel could become contaminated and fouled with biological growth, but the possibility seemed remote and "resided in the background of people's knowledge and concern." That led to some troubles for the military. A decade ago, as the Air Force prepared to ramp up its use of bioderived fuels to comply with green energy initiatives developed during the George W. Bush administration, researchers examined alternative fuels for materials compatibility, Goodson says. They were confirming, for example, that the fatty acid methyl esters that are found in biodiesel would not react adversely with materials in fuel tanks, hoses, pumps, O-rings, and other fuelling equipment. "But they did not consider the effects of microbiology on the fuel system," she notes. That's because most fuels used by the Air Force and other organisations in the past 50 years—meaning petroleum-derived fuels—are not overly susceptible to biofouling. Fleet operators don't normally use pure biodiesel as a transportation fuel. It's expensive, can gel at low temperatures, and may void some engine manufacturers' warranties. So, to go green, the Air Force began using blends of conventional diesel and biodiesel in its trucks and other ground vehicles.

These fatty acid methyl esters, which are common in biodiesel, are readily metabolised by some microbes and enable the organisms to grow in fuel. Eventually, though, that led to contaminated storage tanks, plugged fuel filters, and other problems not commonly seen before the fuel switch,

Goodson says. As a result, some fuel experts pooh-poohed the idea of using alternative fuels, concluding that "bio" meant "bad." Not so, Goodson contends. "There are a whole set of conditions—biological, physiological, and environmental—that have to be met to set off the perfect storm of fuel degradation." Preventing fuel fouling calls for evaluating those details thoroughly. And given that worldwide biodiesel production is on the rise—the Organisation for Economic Co-operation & Development projects an increase from 31 billion L in 2015 to 41 billion L by 2025—the U.S. military isn't the only organization that needs to consider the effects of microbiology on fuels. The common denominator in biocontamination of fuels, alternative and conventional alike, is water. As Passman explains, the reason is simple: Water is an essential factor for microbial activity. Yet preventing its accumulation in fuel systems is difficult. Hot fuel leaving a refinery reactor is sterile, but it doesn't stay that way. While sitting in tanks and pipelines, which aren't airtight, fuel comes into contact with air and water vapour. As the fuel cools during shipping or in storage at tank farms, water becomes less soluble and condenses. Even when tank farm operators follow best housekeeping practices, the condensed water, which is more dense than fuel, accumulates at the bottoms of tanks and low points in pipelines, forming habitats in which fuel-feeding microbes can thrive. "The volume of accumulated water may seem trivial to an engineer, but it's an ocean to a microbe," Passman says. Water problems can be even worse in underground storage tanks and worse still in ones that hold biodiesel, which is more hygroscopic and therefore absorbs more water than conventional diesel does. So underground biodiesel tanks are exactly where a team led by Goodson and University of Oklahoma microbiologist Bradley S. Stevenson recently focused their attention. In a year-long study, the team examined the growth of microbial communities and the extent of bioinduced corrosion in several large underground storage tanks at two U.S. Air Force bases. The study was unique in that it quantitatively probed microbial activity in tanks that were actively in service—specifically, they were being used to store and dispense B20, a commercial biodiesel blend composed of 20% fatty acid methyl esters and 80% conventional ultra-low-sulfur diesel. To look for microbial activity, the researchers immersed polymer-coated metal plates—simulating the materials that storage tanks are made of—to various depths in the tanks. They withdrew and analysed them at regular intervals. They also collected fuel samples from the bottoms of the tanks and compared them with reference samples taken directly from fuel-delivery trucks. What they found was that several microorganisms were wreaking biohavoc in the tanks. The list includes Acetobacteriaceae and other types of bacteria, as well as various yeasts, including Candida and Pichia. But the most prevalent microbe, and the

worst actor by far, was a filamentous fungus of the genus Byssochlamys, a microorganism known to cause food spoilage. That bug, with a little help from its friends, caused the metal plates to visibly foul—become coated with orange and red slimy films—and led to fuel samples that showed varying degrees of turbidity and slime accumulation. The study, which the team has not yet published, also showed that the most heavily fouled plates were the most pitted and corroded ones and that corrosion correlates with levels of fuel acidification. When microbes decompose the fatty acid compounds in the biofuels, they generate organic acids and CO2, species known to promote corrosion. Now that the researchers know which bugs are the troublemakers, they are studying ways to control them. They are also aiming to understand relationships among coexisting microorganisms. As an example, Stevenson explains that the metabolic product of one microbe might be the energy source for a different microbe in that community. Such information could be helpful in combating fuel fouling.

Elsewhere at AFRL, biologist Oscar N. Ruiz works with collaborators at the University of Dayton Research Institute to fight fuel fouling in other ways. They use genomics methods to understand the molecular machinery in microbes that enables them to metabolize fuel. That's the first step in mitigating the problem, Ruiz says. A few years ago, Ruiz and co-workers studied Pseudomonas aeruginosa, a bacterium that readily decomposes jet fuel alkanes, especially those in the C11–C18 range. To thrive, the microbe needs to protect itself from toxic aromatic and cyclic hydrocarbons also found in jet fuel. It turns out that P. aeruginosa uses efflux pumps, protein transporters in cell membranes, to drive the poisonous jet fuel components out of its cells. Armed with that information, the team showed that a peptide-based molecule could shut down the organism's efflux pumps and prevent the bacteria from growing in jet fuel (Environ. Sci. Technol. 2013, DOI: 10.1021/es403163k). Compared with treating the fuel with a biocide that's toxic to people, the peptide strategy, for which the team filed a patent, provides a distinct safety advantage. To gain the same type of molecular upper hand over other fuel-degrading microbes, Ruiz and co-workers recently sequenced the genomes of several previously uncharacterized strains of microbes that they isolated from fuel environments. The list includes a strain of Nocardioides luteus, an alkane-degrading bacterium collected from soil polluted with a type of jet fuel called JP-7; Fusarium fujikuroi, a fungus recovered from Jet A fuel; and Pseudomonas stutzeri strain 19, a Gram-negative bacterium that metabolises aromatic hydrocarbons. "This type of biodegradation is like a fuel disease," Ruiz says. The first step in controlling

Gossip

it is understanding the microorganism that causes the disease. That means determining the fuel components that a microbe is capable of decomposing and then identifying the genetic basis for that metabolic function. Microorganisms exist everywhere, including in fuel and fuel systems, Goodson says. There are many circumstances under which they will cause a degradation problem and plenty under which they won't. Sorting through the good guys, the bad guys, and all the fuel types is a major project, but Goodson doesn't let the complexity of the project bug her. "That's the puzzle I like to work on," she says.

Chemical & Engineering News, 5 March 2018

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

Curiosities

Bugs and allergies in pregnancy linked to child developmental disorders, like autism and ADHD

2018-03-07

A new study suggests activation of a mother's immune system during pregnancy, such as during an allergic response, may affect foetal brain development. This could influence the child's susceptibility to psychiatric disorders in later life, such as autism, schizophrenia and attention deficit hyperactivity disorder. Published in the Journal of Neuroscience, the study found a relationship between two proteins released by a mother's immune system during the third trimester of pregnancy and the way a certain brain network involved in the above disorders developed in the infants. Another study published last year suggested activation of the mother's immune system during pregnancy could influence long-term child mental health and developmental disorders, specifically autism. These studies add to growing evidence linking a significant immune response - such as one that develops during flu or food poisoning – in pregnancy to negative outcomes for the woman's offspring later in life. Researchers have termed this exaggerated immune response in pregnancy, which is potentially detrimental to the foetus, as "maternal immune activation" (MIA). The immune system can be thought of as an army. When an infectious agent such as a virus or bacterium invades our body, it can result in illness or fever. Our immune system recognises these danger signals and mounts an attack of its own. This attack, known as the immune response, is carried out by immune molecules and cells that work to neutralise and eliminate threats. In most situations, the immune response protects the body from illness. But it can also be negative in some cases, such as in autoimmune diseases like diabetes (type one), rheumatoid arthritis and multiple sclerosis. In diabetes, a misdirected immune response causes immune molecules to attack the pancreas and reduce insulin-producing cells. It's well established the womb environment is important for the baby's healthy development. This environment is generally stable and well balanced, monitored by the many systems that support well-being, including the nervous and immune systems. When maternal immune activation occurs, this balance is believed to be disrupted. Armies of activated immune molecules, such as cytokines, chemokines and specific antibodies, can increase and alter the internal womb environment. The elevated levels of cytokines and chemokines might interfere with the normal development of the baby, particularly the baby's brain, and the nervous and immune systems.

An exaggerated immune response during pregnancy, known as 'maternal immune activation', could be detrimental to the foetus.

Animal to human studies

Curiosities

Many animal studies, both in rodents and non-human primates, have shown that experimentally induced maternal immune activation causes developmental, behavioural and social deficits in offspring. For example, when pregnant mice are injected with a substance that triggers an immune response, the resulting pups show social impairment, repetitive behaviours and communication difficulties. These animal behaviours have been argued to be similar to those in human developmental disorders such as autism. Studying maternal immune activation in humans is much more complicated. There is no ethical way to induce MIA in mothers to observe how it affects foetal development. All studies are retrospective and show a correlation between two things, which means showing MIA directly causes child development problems is difficult. Population studies (in which mothers and their children are followed over time) show that autoimmune conditions and infections may result in a small increase in the rates of mental health and developmental disorders in children later in life. Our own study found children of mothers who had experienced allergic or asthmatic reactions during pregnancy had a greater severity of autistic symptoms. Understanding how and why the immune system does this remains elusive. It's still unclear, for instance, why the immune system attacks the pancreas in those with diabetes. A combination of genetic and environmental factors is likely responsible. Similarly, in developmental disorders such as autism, we know there are many causes and probably many types of autism. We do not have any biological markers, other than sequencing DNA, to help us identify the different types of autism or markers that help to guide different treatments. But some families report a long history of immune or autoimmune problems. There are also many children whose symptoms are heavily influenced by immune insults, such as fevers and influenza. If we can identify the biological markers involved in the effects of maternal immune activation, we would be able to target therapies for this particular group of children. We may also be able to unravel the intricacies of complicated disorders, such as autism or schizophrenia, by figuring out why certain treatments work in some patients but not others. This would open the possibilities of using targeted tests and therapies to detect or prevent neurodevelopmental disorders in the womb.

The Conversation, 27 February 2018

http://www.theconversation.com

Curiosities

Controversial weedkiller could spell big trouble for monarch butterflies: Report

2018-03-07

By 2019, a weed killing chemical—designed to be used in tandem with genetically modified cotton and soybean seeds—is projected to be sprayed on more than 60 million acres of monarch butterfly U.S. migratory habitat, according to a report released today by the Centre for Biological Diversity. Citing this potential devastation to monarch populations, which have already decreased an estimated 80 percent over the past two decades, the report calls on the U.S. Environmental Protection Agency not to renew the registration of the weed killer, called dicamba, when it expires at the end of this year. The concern is the chemical could cause more habitat loss and decreased milkweed, which is the only food plant used by monarch caterpillars. Monarchs winter in Mexico and some warm areas of Southern California and they return to areas throughout the U.S. in the spring. "America's monarchs are already in serious trouble, and this will push them into absolute crisis," said report author Nathan Donley, a senior scientist at the Centre, in a statement. Donley and colleagues looked at monarch habitat in the U.S. and estimated how much dicamba will be sprayed. In addition to the estimated 60 million acres to be sprayed, an additional 9 million acres could be threatened by the chemical drifting. The weed killer gained notoriety this year as farmers planted more than 25 million acres with new soybean and cotton seeds genetically modified to be resistant to dicamba. Monsanto, BASF SE and DowDuPont all make dicamba-based herbicides. In many areas the weed killer drifted onto nearby fields and killed crops, spurring lawsuits in Arkansas, Missouri, Kansas and Illinois. Arkansas banned dicamba; North Dakota, Missouri and Minnesota put restrictions in place. "In 2017 there were reports of at least 3.6 million acres of off-target, herbicide-induced damage to agricultural crops and an unknown amount of damage to native plants and habitats, including forests," according to the Centre's report. Dicamba is a threat to monarchs because it can destroy flowering plants that provide nectar for adult butterflies as they travel south for the winter and by harming milkweed, which is the "only food source of the monarch caterpillar" and "provides an essential resource for reproduction," stated the report. "When dicamba's use on [genetically engineered] cotton and soybeans come up for reapproval later this year, the only responsible thing for the EPA to do is allow that approval to expire," Donley said.

Environmental group reports over the next year more than 60 million acres of the monarch's US migratory habitat will be sprayed with dicamba

Environmental Health News, 2 March 2018

http://www.environmentalhealthnews.org/

Curiosities

20 years ago, research fraud catalysed the anti-vaccination movement. Let's not repeat history.

2018-03-07

Exactly 20 years ago this month, an esteemed medical journal published a small study that has become one of the most notorious and damaging pieces of research in medicine. The study, led by the now discredited physician-researcher Andrew Wakefield, involved 12 children and suggested there's a link between the measles, mumps, and rubella vaccine — which is administered to millions of children around the world each year — and autism. The study was subsequently thoroughly debunked. The Lancet retracted the paper and Wakefield was stripped of his medical license. Autism researchers have shown decisively again and again that the developmental disorder is not caused by vaccines. Still, public health experts say the false data and erroneous conclusions in that paper, while rejected in the scientific world, helped fuel a dangerous movement of vaccine scepticism and refusal around the world. Since its publication, measles outbreaks have erupted in Europe, Australia, and the US in communities where people refuse or fear vaccines. Vaccine refusal has become such a problem that some countries in Europe are now cracking down, making vaccines mandatory for children and fining parents who reject them. But there's more to the story. While the World Health Organization's 2015 target to eliminate measles has not yet been met, progress against the disease has actually continued globally. So, the 20th anniversary of Wakefield's paper is a good time to assess where we are with measles, to look back at the science behind the measles-autism link and consider how we can prevent another dubious idea that's harmful to public health from taking hold.

Andrew Wakefield's fraudulent paper suggesting a link between vaccines and autism shouldn't have been published — let alone showered in media attention.

<u>The MMR vaccine-autism study was dubious science</u>

The first thing to know about Wakefield's paper is that it was very dubious science. It did not deserve to be published in a top-tier medical journal — let alone receive all the attention its subsequently gotten. Wakefield drew the association between the measles-mumps-rubella (MMR) vaccine and autism based on a study involving only 12 children. The paper was also a mere case report. "Case reports" are detailed stories about particular patients' medical histories, and — because they are basically just stories — they are considered among weakest kinds of medical studies. To be sure, these reports can be useful — but they are certainly not the evidence on which you want to make bold claims about something like the vaccine-autism link. Many children have autism and nearly all take the MMR vaccine. Finding in this case that among a group of a dozen children most

of them happen to have both is not at all surprising. And it in no way proves the MMR vaccine causes autism. (Wakefield also proposed a link between the vaccine and a new inflammatory bowel syndrome, which has since been called "autistic enterocolitis" and also discredited.) What's more, when a British investigative journalist Brian Deer followed up with the families of each of the 12 kids in the study, he found, "No case was free of misreporting or alteration." In other words, Wakefield, the lead author of the original report, manipulated his data. Wakefield also had major financial conflicts of interest. Among them, while he was discrediting the combination MMR vaccine and suggesting parents should give their children single shots over a longer period of time, he was conveniently filing patents for single-disease vaccines. Even more absurdly, the General Medical Council (the UK's medical regulator) found that he had paid children at his son's 10th birthday party to donate their blood for his research. (In deciding to take away his UK medical license, the GMC said Wakefield acted with "callous disregard for the distress and pain the children might suffer.") Finally, Wakefield never replicated his findings. At the very bedrock of science is the concept of falsification: A scientist runs a test, gathers his findings, and tries to disprove himself by replicating his experiment in other contexts. Only when that's done can he know that his findings were true. As the editor of the BMJ points out, "Wakefield has been given ample opportunity either to replicate the paper's findings or to say he was mistaken. He has declined to do either." In 2004, 10 of his co-authors on the original paper retracted it, but Wakefield didn't join them, and he has since continued to push his views, including doing the rounds on the anti-vaxxer speakers' circuit and publishing books. It's no surprise that the idea that the MMR vaccine may cause autism has been debunked by large-scale studies involving thousands of participants in several countries.

<u>But the whole debacle isn't only Wakefield's fault</u>

So how did such a shoddy paper gain such outsized influence? The second thing to know about Wakefield's study is that the media helped it go viral. One of my favourite writings on the Wakefield debacle comes from the British journalist-researcher Ben Goldacre. In a column for the Guardian, and in his book Bad Science, Goldacre pointed out that journalists were complicit in helping perpetuate the notion that vaccines cause autism: Wakefield was at the centre of a media storm about the MMR vaccine, and is now being blamed by journalists as if he were the only one at fault. In reality, the media are equally guilty. Even if it had been immaculately well conducted – and it certainly wasn't – Wakefield's "case series report" of 12

children's clinical anecdotes would never have justified the conclusion that MMR causes autism, despite what journalists claimed: it simply didn't have big enough numbers to do so. But the media repeatedly reported the concerns of this one man, generally without giving methodological details of the research, either because they found it too complicated, inexplicably, or because to do so would have undermined their story. We journalists are still doing this today on myriad health topics. We report on single, often-poorly designed studies — even if they don't deserve an ounce of attention. We also focus a lot more on the anti-vaccine movement, and their concerns, than the astounding progress made against vaccine-preventable diseases. Part of this has to do with how newsrooms work: We journalists favour anomalies and novelty instead of slow and plodding progress, as Steven Pinker points out in his new book, Enlightenment Now. But in doing so, we lose sight of the big picture. Vaccines, Pinker notes, have been critical to the progress we've made during the past century against death and disease. The discovery of a smallpox shot, for example, helped turn a gruesome and painful illness — which killed more than 3 million people in the 20th century — into a thing of the past. (Smallpox is the only disease that's been eradicated, with the last case turning up in Somalia in 1977.)

More recently, since 1990, childhood deaths from infectious diseases like HIV and measles (yes, measles!) have continued to decline around the world, thanks to both vaccines and infection control practices. A recent chart from the US Centres for Disease Control and Prevention shows that measles deaths with vaccination have continued to drop around the world through the 2000s. "For the first time," the report read, "annual estimated measles deaths were fewer than 100,000, in 2016." Measles cases in the US in recent years have held fairly steady since the disease was eliminated here in 2000 (meaning it's no longer endemic). These days, mostly sporadic outbreaks occur, which are typically sparked by travellers returning to unvaccinated communities — like the 2014 outbreak among an unvaccinated Amish community in Ohio. Again, the progress against measles happened because of routine immunisation services becoming increasingly available here and abroad. Since 2000, some 5.5 billion doses of measles-containing vaccines have been given to kids, saving an estimated 20.4 million lives. So, the most powerful contributor to the fight against vaccine-preventable diseases was science, Pinker reminds us. Let's not lose sight of that by focusing too much on bad science. But truly stopping the spread of dubious science will require a lot more than developing a more sceptical media. As I've written before, it must also involve thinking about how to prevent bad science from taking off in the

first place by educating young people in critical thinking skills. Creating armies of little bad science detectors — who can easily spot a shoddily designed study — is the only way to inoculate ourselves against another Wakefield debacle.

Vox, 27 February 2018

https://www.vox.com

Here's why Lego is swapping plastic for plants

2018-03-07

Lego has been searching for a sustainable alternative to plastic since 2015, and it has found a solution in sugarcane fields. Today, the company said it has started production on a new line of Lego elements made from plant-based plastic sourced from sustainably grown sugarcane. The toys are made from polyethylene derived from the plant, but, according to a press release, "are technically identical to those produced using conventional plastic," meaning they will probably still hurt like hell to step on. "We want to make a positive impact on the world around us and are working hard to make great play products for children using sustainable materials," Tim Brooks, vice president, environmental responsibility at the Lego Group, said in a statement. "This is a great first step in our ambitious commitment of making all Lego bricks using sustainable materials." To start, appropriately enough, Lego is focusing on making the botanical elements of its play sets out of the plant-based plastic–leaves, bushes, and trees. However, more is coming. The move is part of the Lego Group's commitment to use sustainable materials in core products and packaging by 2030. Lego was recently named one of Fast Company's Most Innovative Companies for 2018.

Lego has been searching for a sustainable alternative to plastic since 2015, and it has found a solution in sugarcane fields.

Fast Company, 3 March 2017

http://www.fastcompany.com/

Four ways alcohol is bad for your health

2018-03-07

In Australia, almost 6,000 deaths a year can be attributed to alcohol, as well as around 400 hospitalisations a day. While drinking has declined in some segments of the population, with related stabilising of rates of death and illness, these numbers are far too high. Similar reports are emerging in other countries. Many people remain unaware, blissfully or otherwise, of long-term risks, which aren't just restricted to "heavy

drinkers". Alcohol is one of the largest risk factors for avoidable death and illness. The growing list of alcohol-related diseases includes bowel cancers, mouth and oesophageal cancers, breast cancers, heart disease, respiratory infections and mental health problems. Some evidence is emerging of a link with other diseases such as prostate cancer. We have also seen the transgenerational impact through foetal alcohol spectrum disorders (FASD). These are lifelong and severe disorders that occur as a result of exposure to alcohol in the womb. Here are four diseases evidence shows are linked strongly with alcohol consumption.

1. Cancer

In total, cancers account for the largest proportion (more than one-third, or around 2,000 Australian deaths a year) of alcohol-attributable deaths. Breast cancer is the leading cause of death for women, followed by liver disease. For men, the leading cause is liver disease, followed by bowel cancer. Three decades ago, the World Health Organisation identified alcohol as a group one carcinogen, in the same category as tobacco. But many health professionals and others still don't connect alcohol and cancer. It has been estimated that alcohol is a leading cause of cancer worldwide, contributing to 770,000 cases. Cancer risk can increase at relatively low levels of consumption and rises the more you drink. It's also influenced by individual vulnerability. For bowel cancer, risk increases from two standard drinks a day. For every standard drink, breast cancer risk for women increases by around 12%. Cancers of the larynx (voice box) increase from one standard drink a day – daily consumption of ten standard drinks a day increases the risk four-fold compared to not drinking. Similar evidence exists for mouth, oesophageal and liver cancers. Emerging evidence suggests we also need to consider associations with prostate, pancreatic, lung and gallbladder cancers and malignant melanoma.

2. Heart disease

There are strong claims about the benefits of low doses of alcohol. But systematic reviews (where multiple studies are analysed) conclude that there is no net benefit, or very limited benefit, of moderate drinking over abstention. Even where protective effects for the heart are identified, these are often at very low levels of consumption (such as one standard drink every other day). There is evidence alcohol is associated with high blood pressure, ischaemic heart disease and stroke. Heart diseases attributed to alcohol are major contributors to death and hospitalisations in Australia.

3. Injury

Alcohol consumption affects judgment, reaction time and contributes to risk-taking. Alcohol-related injuries from falls, drowning, vehicle accidents and violence contribute to a high proportion of hospitalisations in Australia and overseas. Falls and assaults contribute to 21% of alcohol-attributable hospitalisations in Australia. These injuries resonate through the whole community in terms of harm to family members, innocent bystanders and the cost to our policing and health systems.

4. Neuropsychiatric disorders

Neuropsychiatric conditions, which include alcohol dependence and abuse, are the leading causes of alcohol-attributable hospitalisations (37%) in Australia. Mental health conditions associated with alcohol include depression, self-harm and suicide. Evidence is emerging of alcohol's impact on the developing brain and the significant cost of alcohol-acquired brain injury is well established.

Knowing your risk

There are guidelines to help drinkers understand risk. Individual vulnerability and the context in which you drink are relevant. But, in general, low-risk drinking to avoid alcohol-related death is two standard drinks or less a day. Single-occasion low-risk drinking is four standard drinks or less. The safest option for those thinking about pregnancy, or who are pregnant, and for those under 18 years old, is not to drink. Exposing an unborn child to alcohol is a dose-dependent risk that can endure across their lifetime.

The Conversation, 2 March 2018

http://www.theconversation.com

The key to treating multiple sclerosis could be inside sufferers' own bodies

2018-03-07

Fat often gets a bad press, but if it didn't coat the cables that connect our neurons, we'd be in a lot of trouble. Sufferers of multiple sclerosis and a host of other nervous system diseases have first-hand experience of this, with few safe and effective treatment options available. Only now are new treatments appearing on the horizon that might just make a big difference. In order for us to think, feel and move, information must move around the brain accurately and rapidly. Vital in this process are long wire-like structures called axons, which conduct the electrical currents

Now, a different kind of stem cell offers exciting potential for a raft of new treatments that could reverse symptoms of MS and other myelin diseases, rather than just slow them – and without the need for transplantation.

that encode our thoughts from neuron to neuron. Most of our axons are sheathed in a fatty substance called myelin which, like the plastic coating on a wire, provides insulation for efficient conduction and protects the axon from damage. Unfortunately, many diseases damage these myelin sheaths. For example, in multiple sclerosis (MS), the immune system – usually our body's defence against disease – attacks its own myelin in the brain and spinal cord, leaving the underlying axons exposed. Like a worn-down phone charger, these bare axons can no longer conduct electricity effectively, and are vulnerable to damage. Depending on which cables are damaged, this can cause tingling, weakness, visual problems, and eventually difficulty moving, speaking and swallowing. Most current therapies for MS attempt to stop the immune system from attacking the myelin sheaths. This can reduce damage, but it can't reverse it. So, the condition of many patients deteriorates even while on these drugs. Stem cell transplantation therapy has shown recent promise in treating MS, but such treatments are aggressive and can seriously endanger patients' health, requiring chemotherapy to almost completely eliminate the patient's immune system before attempting to reboot it to an earlier, more healthy stage. Now, a different kind of stem cell offers exciting potential for a raft of new treatments that could reverse symptoms of MS and other myelin diseases, rather than just slow them – and without the need for transplantation.

A new hope

After myelin damage, stem cells called OPCs can create specialised brain cells called oligodendrocytes, which send octopus-like arms to wrap new myelin around damaged axons. OPCs are already scattered throughout the brains of MS sufferers, but only in some people do they produce enough of the specialised brain cells that regenerate myelin, and therefore reduce symptoms. Recent years have seen great advances in our understanding of how to influence OPC stem cells to respond properly to myelin damage. We can now grow them in hundreds of tiny artificial wells, each containing a different drug and several microscopic axon-mimicking cables, and examine which drugs best kick-start the OPCs into re-myelinating action. This innovative lab technique is helping researchers to fast identify the most promising concoctions to take to clinical trials. Surprisingly, recent discoveries also show that the same immune system responsible for attacking and damaging myelin can also play a beneficial role in regenerating it. For example, immune cells called microglia can gobble up the debris of the old myelin sheaths, clearing the way for new myelin to regenerate. Drugs targeting this process have already helped mice

to regenerate myelin and will likely be seen in clinical trials soon. What's more, new medical imaging technologies will allow us to monitor how well all of these new drugs regenerate myelin inside patients in real time. The next few years will be an exciting time, as we begin to see clinical data on how these new drugs can help people living with MS. After years of struggle to find an effective treatment, we may just find that the key was inside our bodies all along.

The Conversation, 28 February 2018

http://www.theconversation.com

A Woman Had to Get Her Hip Replaced Because a Dog Scratched Her Hand

2018-03-07

Occasional nicks, scratches, and bites can be an unavoidable consequence of being a pet owner, when our animal friends unintentionally hurt us. But one British woman's experience shows we should never assume such minor pet-inflicted injuries are necessarily harmless – because this otherwise healthy 66-year-old ended up having to get her hip replaced after being scratched by her pet dog. The patient, who had previously undergone a total hip replacement in 1997, presented to her orthopaedist after experiencing groin and buttock pain for a number of months. At first, the woman feared she might have developed cancer in the region, so she was understandably relieved when scans showed no evidence of a tumour – but doctors weren't entirely sure what the source of her pain was. Suspecting some kind of infection in the woman's prosthetic joint, they took a biopsy from her hip to see if they could detect any pathogens in her blood. Cultivating the sample in a microbiology lab, six out of seven of the lab cultures indicated nothing – but the seventh revealed a gram-negative bacterium that couldn't be identified. "Unfortunately, the biopsy results were inconclusive," the anonymous patient recalls. "All this time, the pain was becoming worse, and I was becoming increasingly frightened by what might actually be happening to me." A second biopsy was eventually taken, again showing evidence of some kind of unknown bacteria, so the doctors sent the samples off to a specialist microbiology reference laboratory at Cardiff University for further identification. By this point, some 14 months after the woman first approached her doctors, the "horrendous pain" caused by the infection was almost unbearable, with imaging showing significant cortical destruction near the hip end of the femur due to the infection. Using a molecular technique called 16S PCR, scientists finally figured out the source of the problem: an extremely rare

Occasional nicks, scratches, and bites can be an unavoidable consequence of being a pet owner, when our animal friends unintentionally hurt us.

infection by Capnocytophaga canimorsus, only reported in prosthetic devices like this twice before in medical literature, and never before with such persistent, slowly developing symptoms. While C. canimorsus doesn't turn up often in things like artificial hips, it is in fact the primary bacterial risk from dog bites (the bug lives in about one in four dog mouths, and is also present in cats), and can cause septicaemia, meningitis, endocarditis, and ocular infections if left unchecked. In this case, the patient recalled she had been scratched by her dog (whose breed remains unknown) on the back of her hand about nine months before seeing doctors about her groin pain. That scratch was all it took. The doctors hypothesise the animal transferred the bacteria from the oral flora in its mouth to its claws by licking its paws, which subsequently enabled the woman to become infected by nothing more than a scratch. Luckily for her, after several months of intense pain, she was administered a course of antibiotics to kill the infection and received a new artificial hip. As of her last check-up 15 months after the surgery, the doctors report she is functioning well with a pain-free hip – although the mysterious, painful memory of her brush with C. canimorsus is not something she can easily forget. "The worry never goes away," she says. "The fear that something similar could happen again is always at the forefront of my mind." There's no word on how the dog is getting on – but given what we know about canine psychology, it's safe to say it's probably not feeling too guilty about things. The findings are reported in BMJ Case Reports.

Science Alert, 5 March 2018

http://www.sciencealert.com.au

Scientists Have Revealed What Your Brain Really Does When You're Unconscious

2018-03-07

Of all of the brain's functions, it's probably fair to say its ability to produce consciousness is the most challenging for us to make sense of. To better understand how our grey matter accomplishes this perplexing task, researchers from the University of Michigan's Centre for Consciousness Science have taken a closer look at what the brain is doing when it's drifting into unconsciousness. Right now, you've chosen to click on this article, run your eyes down the page, and decide whether to keep reading or not. Meanwhile there might be voices chattering nearby, the sensation of a chair beneath your legs, and a rumbling in your stomach ... none of which you were thinking about until you read it here. Whatever makes you aware of these things and allows you to govern responses at will, it's

Of all of the brain's functions, it's probably fair to say its ability to produce consciousness is the most challenging for us to make sense of.

clearly got something to do with the brain. Beyond that, there's still a lot we don't know with confidence. One way to investigate the subject is to compare the conscious state with the unconscious one, such as when we're knocked out before surgery. Without giving it too much thought, we might assume being unconscious is a little like flicking a switch, turning off our awareness by shutting down key areas of our nervous system. Anaesthesiologist George Mashour doesn't think that's the case at all. "I published a theoretical article when I was a resident in anaesthesiology suggesting that anaesthesia doesn't work by turning the brain off, per se, but rather by isolating processes in certain areas of the brain," says Mashour. Like any good scientist it wasn't enough to speculate – Mashour wanted to put his hypothesis to the test. So, with several teams of researchers he conducted a variety of investigations to see exactly what was happening across the brain as it shifted between conscious states. In the first study, Mashour and his colleagues monitored blood flow in certain nervous tissues using functional MRI scans, comparing the measurements in 23 patients who were either sedated, undergoing surgical anaesthesia, or in a vegetative state. They specifically looked at the timing across areas of the brain as they coordinated incoming information. What they found indicated that some areas seem to chat more to themselves as the timing of communications stretched out. "We showed in the early stages of sedation, the information processing timeline gets much longer and local areas of the brain become more tightly connected within themselves," says the study's senior author anaesthesiologist Anthony Hudetz. The second study took on the challenge of measuring how that information actually integrates in the brain. To quantitatively describe that measure of integration, a research area known as integrated information theory (IIT) uses a value designated by the Greek letter phi. It's thought that in the brain, phi corresponds with consciousness in some way. Nailing down that figure isn't a simple pursuit, so the researchers broke down the task into more manageable, practical steps based on electroencephalogram (EEG) readings. "We demonstrated that as the brain gets more modular and has more local conversations, the measure of information integration starts to decrease," explains physicist and anaesthesiologist, UnCheol Lee. The results from those two studies suggest phi – the measure of integration of information – shrinks as the timing of communications across the brain's disparate regions also shrinks, and their activity turns inward. In their final report they reviewed their results against the latest literature, summing up their understanding of how our brains function during sleep, general anaesthesia, and disorders of consciousness. "We found that during unconsciousness, disrupted connectivity in the brain and greater modularity are creating an environment that is inhospitable to the kind

of efficient information transfer that is required for consciousness," says Mashour. While it still leaves plenty of unanswered questions, the work does more than just point the way to how consciousness arises from a healthy brain; it could help us better distinguish when unresponsive patients are still aware. It's increasingly becoming clear that the difference between consciousness and unconsciousness is far more complicated than we realised. And knowing more about the processes that make us awake and aware could help us one day solve one of the brain's most puzzling talents - the very existence of consciousness. This research was published in the Journal of Neuroscience, Frontiers in Human Neuroscience, and Trends in Neurosciences.

Science Alert, 2 March 2018

http://www.sciencealert.com.au

There's Worrying New Evidence That Arctic Soils Are Releasing Ancient Stored Carbon

2018-03-02

Scientists recently published new evidence that old or even ancient carbon, pulled out of the atmosphere and stored in the bodies of plants hundreds or thousands of years ago, is being set loose again from soils in the Arctic region. It's a potentially worrying indicator that these "permafrost" soils may already be worsening the problem of climate change. However, scientists are still debating just how much old carbon Arctic soils should release normally even without climate change, leaving the ultimate significance of the findings unclear. The new study, which was published in the journal Environmental Research Letters, employed radiocarbon dating to examine the content of river and lake waters in Canada's Northwest Territories in 2014. It found an increasing prevalence of older dissolved carbon and carbon dioxide in the waters as the summer advanced. The research also discovered one case of carbon in methane gas that was more than 2,000 years old. The new work isn't definitive on the question of increasing permafrost carbon emissions - but it's something to worry about, said Joshua Dean, the study's lead author and a researcher at the Vrije University in Amsterdam. "I would say if you're looking at anything pushing several hundred years old to a thousand years old, then you have to start wondering whether that should be coming out of this kind of system," said Dean, who published the work with 11 colleagues from universities and institutions in Britain. Over thousands of years, the Arctic has stored up massive amounts of carbon as plants have died but have not fully decayed because of the region's cold temperatures. Instead,

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their roots and other plant parts have been preserved in the frozen soil. Layer upon layer of Arctic soil has built up, representing a kind of time capsule with the oldest layers, and the oldest carbon, generally found at the greatest depths. As a warming climate thaws this permafrost, more and more of the older carbon will be broken down by microbes and released as carbon dioxide or methane, with the potential to greatly warm the planet. But it's not clear how much carbon is vulnerable or how fast such a release could happen. That's where the new research comes in. Scientists know the precise rate at which one variant of carbon found in the atmosphere, carbon-14, decays into another variant. Thus, by determining the ratios of these types of carbon in samples taken from the Arctic, they can determine when the carbon was first drawn out of the atmosphere and into a plant - its "age." The new research is one in a string of studies that have used such a method to detect old carbon emerging from Arctic lakes or rivers, or Arctic soils, going at least back to 2009.
In a paper that year, Ted Schuur of Northern Arizona University and his colleagues found older carbon emerging from thawed permafrost regions in the Eight Mile Lake watershed of the Alaska Range. Since then, a 2016 study in Nature Geoscience examined Arctic lakes in multiple regions and found that "that methane age from lakes is nearly identical to the age of permafrost soil carbon thawing around them." Meanwhile, a 2018 study in Nature Climate Change found that carbon dioxide and methane emissions from lakes in Alaska mostly came from carbon that had been fixed by plants within the last 3,000 to 4,000 years, but also that a small percentage was even older than that. And then there's the latest study - which was aimed at trying to establish a basic measurement of how much old carbon is flowing into the waters of the Northwest Territories region. Determining whether those amounts are unusual, or whether levels are changing, remains for subsequent work, Dean said. So, what does it all add up to? That's the big question. Schuur said in an email that these studies, "taken together," suggest that "increased old C release is a fingerprint of changing Arctic carbon cycle." "Of course, magnitude matters, but I think the concept of old carbon entering the modern carbon cycle is an important one indicating change from the status quo," Schuur added. However, other researchers have had differing interpretations. "Yes, we can detect old carbon in these systems, but you need to know whether that is what we would expect to be happening anyway, just based on natural carbon cycling," said Dean, the lead author of the newest study. "It is currently unclear what constitutes a 'steady state scenario' for various Arctic ecosystems, specifically what a deviation from the expected carbon cycling in an undisturbed environment would look like," said Clayton Elder and Claudia Czimczik, researchers at the University of California at

Irvine who conducted the Nature Climate Change study, in an emailed statement. The researchers further suggested that whether permafrost carbon of a particular age is considered old or young can depend in part upon the type of Arctic environment from which it emerges, and in some cases may not be really "old" or "ancient" until it has aged between 5,000 and 10,000 years. One reason it's difficult to find a smoking gun in this area is a phenomenon called "cryoturbation," which refers to "a mixing of soil layers due to seasonal freeze and thaw process, brings old carbon up and young carbon down into the soil column," said Anna Liljedahl, a professor at the University of Alaska at Fairbanks who studies Arctic ecosystems. She was not involved in the study. Still, Dean said that even though his study can't clearly prove that the Arctic has shifted in such a way as to release more older carbon, his results are concerning. "Certainly, it's a warning sign for the future," he said. Liljedahl agreed. "I think they are on to something. More studies like these would strengthen the story and evidence," she said by email.

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Type 2 Diabetes Was Misdiagnosed All Along, It Could Actually Be Several Diseases

2018-03-07

What if diabetes wasn't just one condition with two types, but a whole bunch of diseases under the same label? That's the conclusion of new research, and it could revolutionise the way we detect and treat diabetes in the future.

What if diabetes wasn't just one condition with two types, but a whole bunch of diseases under the same label? That's the conclusion of new research, and it could revolutionise the way we detect and treat diabetes in the future. Analysing past studies covering a total of 14,775 type 1 and type 2 adult-onset diabetes patients across Sweden and Finland, scientists have found five different and distinct disease profiles, including three severe and two mild forms of the condition. The more precise we can be about different categories of diabetes, the better we can understand and treat it, according to the team of researchers from Scandinavia. It might even give doctors an earlier window of opportunity for preventing the onset of diabetes. "Evidence suggests that early treatment for diabetes is crucial to prevent life-shortening complications," says senior researcher Leif Groop, from the Lund University Diabetes Centre (LUDC) in Sweden. "More accurately diagnosing diabetes could give us valuable insights into how it will develop over time, allowing us to predict and treat complications before they develop." Six different measurements were used across four separate studies: age at diagnosis, body mass index (BMI), long-term glycaemic (blood sugar) control, the function of insulin-producing

cells in the pancreas, insulin resistance, and the presence of specific autoantibodies linked to autoimmune diabetes. Instead of splitting diabetes simply into type 1 and type 2, the researchers came up with five different disease profiles - one autoimmune type of diabetes and four other distinct subtypes. All five types were found to be genetically distinct, with no shared mutations. This is enough to suggest we're looking at five distinct diseases that all affect the same body system, rather than the same disease at different stages of progression, say the researchers. So how did they differ? One of the three more serious forms were a group of people with severe insulin resistance and a significantly higher risk of kidney disease. Another milder type was seen mostly in elderly people. You can see how those distinctions could improve the way we tackle diabetes – by identifying the types of patients involved and the complications they're at risk from, doctors could work out more personalised courses of treatment. Indeed, the researchers found that many in the study weren't being given the right treatment for the particular characteristics of the diabetes they had. With diabetes now the fastest-growing disease on the planet, more options for dealing with it can't come soon enough. More than 420 million people are now thought to have diabetes worldwide. Between 75-85 percent of people with diabetes have the more common type 2, where the body can't produce enough insulin to cope with levels of insulin resistance. The researchers do note some limitations though: there's no evidence yet that these five types of diabetes have different causes, and the sample only included Scandinavian patients, so a wider study is going to be required to investigate this further. "Existing treatment guidelines are limited by the fact they respond to poor metabolic control when it has developed, but do not have the means to predict which patients will need intensified treatment," says Groop. "This study moves us towards a more clinically useful diagnosis and represents an important step towards precision medicine in diabetes." The research has been published in The Lancet Diabetes & Endocrinology.

Science Alert, 1 March 2018

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Cells in the nervous system can "put the brakes" on the immune response to infections in the gut and lungs to prevent excessive inflammation, according to research by Weill Cornell Medicine scientists.

Nervous system puts the brakes on inflammation

2018-03-07

Cells in the nervous system can "put the brakes" on the immune response to infections in the gut and lungs to prevent excessive inflammation, according to research by Weill Cornell Medicine scientists. This insight may one day lead to new ways to treat diseases caused by unchecked

inflammation, such as asthma and inflammatory bowel disease. The study, published March 1 in Science, provides some clues about what might be going wrong in these diseases, which have become more common in industrialized countries, and in helminth infections, which are still a major public health problem in less-industrialized countries. It also may explain how some existing treatments for diseases like asthma work and point to new treatment strategies. "There is a crosstalk between the nervous system and the immune system, and that plays an important role in regulating acute and chronic inflammation," said Dr. David Artis, director of the Jill Roberts Institute for Research in Inflammatory Bowel Disease and the Michael Kors Professor of Immunology at Weill Cornell Medicine. "Those two organ systems are closely interacting and play an important role in human health and disease." For their study, Dr. Artis and his colleagues examined communication between the nervous system and immune system during the kind of inflammatory response that is triggered by allergens or infections with parasites called helminths. Exposure to these agents causes a class of immune cells called group 2 innate lymphoid cells (ILC2) to release inflammatory molecules called cytokines that can promote increased mucus production and muscle contractions--all of which help to expel the parasite or allergen from the body. Too much or prolonged inflammation can be harmful, so Dr. Artis and his team wanted to understand how the body dampens this response. ILC2s have receptors on their surface called β2 adrenergic receptors (β2AR) that interact with a chemical called norepinephrine that nerve cells release. These receptors give nerve cells the ability to interact with each other and influence the immune response. To determine the role of β2AR in communication between the two systems, Dr. Artis and his colleagues employed mice that lack the receptor and then infected them with helminths. The rodents had an exaggerated immune response to the infection and faster expulsion of the parasites. By contrast, when they treated normal mice with drugs that stimulate β2AR, the immune response was blunted and the helminth infections worsened. "We found that those beta-adrenergic receptors controlled the proliferation of the ILC2 cells," said lead author Dr. Saya Moriyama, a postdoctoral associate in Dr. Artis' laboratory, noting that the receptors may help prevent too much inflammation. If these results are confirmed in humans, it could have very important implications for patients with asthma, allergies and other types of inflammatory diseases. The most commonly used drugs to treat asthma also stimulate β2AR, which may explain why they are so effective at controlling allergy symptoms. "We must have given tens of millions of doses of these drugs to shut down the acute symptoms of asthma," Dr. Artis said. "Nobody could agree on how these drugs work, but it may

be that they are working in part through targeting the innate immune system." "If we understand more mechanistically how this class of drugs works," he added, "it might give us new avenues to develop additional therapies built around the biology."

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http://www.eurekalert.org

Study shows smartphones and data centres harm the environment

2018-03-07

At the end of winter term in 2014, Lotfi Belkhir was approached by a student taking his Total Sustainability and Management course who asked, "What does software sustainability mean?" The Entrepreneurship and Innovation Associate Professor at the W Booth School of Engineering Practice and Technology didn't have an answer. Belkhir teaches students to think creatively about sustainability tools that can be applied to their entrepreneurial ventures. But his tools, at the time, mainly applied to hardware start-ups, not software. The student's question sparked Belkhir's latest research on the global emissions footprint of information and communications technology (ICT). Belkhir, along with Ahmed Elmeligi, a recent W Booth grad and co-founder of the start-up, HiNT (Healthcare Innovation in NeuroTechnology), studied the carbon footprint of consumer devices such as smartphones, laptops, tablets, desktops as well as data centres and communication networks as early as 2005. Their findings were recently published in the 2018 Journal of Cleaner Production. Not only did they discover that software is driving the consumption of ICT, they also found that ICT has a greater impact on emissions than we thought and most emissions come from production and operation. "We found that the ICT industry as a whole was growing but it was incremental," Belkhir explains. "Today it sits at about 1.5%. If trends continue, ICT will account for as much as 14% for the total global footprint by 2040, or about half of the entire transportation sector worldwide." "For every text message, for every phone call, every video you upload or download, there's a data centre making this happen. Telecommunications networks and data centres consume a lot of energy to serve you and most data centres continue to be powered by electricity generated by fossil fuels. It's the energy consumption we don't see." Among all the devices, trends suggest that by 2020, the most damaging devices to the environment are smartphones. While smartphones consume little energy to operate, 85% of their emissions impact comes from production. A smartphone's

Data centres and smartphones will be the most damaging information and communications technologies to the environment by 2040, according to new research from W Booth School's Lotfi Belkhir.

chip and motherboard require the most amount of energy to produce as they are made up of precious metals that are mined at a high cost. Smartphones also have a short life which drives further production of new models and an extraordinary amount of waste. "Anyone can acquire a smartphone, and telecommunications companies make it easy for people to acquire a new one every two years. We found that by 2020 the energy consumption of a smartphone is going to be more than that of PCs and laptops." Belkir has made policy recommendations based on his findings. "Communication and data centres have to go under renewable energy now. The good news is Google and Facebook data centres are going to run on renewable energy. But there needs to be a policy in place so that all data centres follow suit. Also, it's not sustainable to have a two-year subsidised plan for smartphones." With his latest research, Belkhir hopes to help students in his Total Sustainability and Management course expand their worldview. "When they start the course, many students don't know what sustainability means. When the course ends their worldview has changed and they realize what they want to do and why they want to do it."

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Researchers uncover culprit in Parkinson's brain cell die-off

2018-03-07

An estimated 10 million people worldwide are living with Parkinson's disease—an incurable neurodegenerative disorder that leads to an increasing loss of motor control. If we could peer into the brains of these patients, we'd see two hallmarks of the disease. First, we'd see a die-off of the brain cells that produce a chemical called dopamine. We'd also see protein clumps called Lewy bodies inside the neurons. Corinne Lasmézas, DVM, PhD, a professor on the Florida campus of The Scripps Research Institute (TSRI), believes a key to treating Parkinson's is to study possible links between these two phenomena. Now her group has discovered a connection between neuronal death and Lewy bodies. The research, published recently in the journal Proceedings of the National Academy of Sciences, offers an explanation for why neurons die off in the first place. 'This study identifies the missing link between Lewy bodies and the type of damage that's been observed in neurons affected by Parkinson's," says Lasmézas, senior author of the study. "Parkinson's is a disorder of the mitochondria, and we discovered how Lewy bodies are releasing a partial

This study identifies the missing link between Lewy bodies and the type of damage that's been observed in neurons affected by Parkinson's

break-down product that has a high tropism for the mitochondria and destroys their ability to produce energy."

Toxic protein travels to mitochondria to do damage

Lewy bodies were described a century ago, but it was not until 1997 that scientists discovered they were made of clumps of a misfolded protein called α-synuclein. When it's not misfolded, α-synuclein is believed to carry out functions related to the transmission of signals between neurons. Lasmézas' research focuses on neurological disorders caused by misfolded proteins, such as Alzheimer's, Parkinson's, prion diseases, frontotemporal dementia and amyotrophic lateral sclerosis (ALS, Lou Gehrig's disease). She uses lab models, including cell cultures and mice, to study these diseases. In the current study, Lasmézas and her team looked at cell cultures of neurons that were induced to accumulate fibrils made of misfolded α-synuclein, mimicking Lewy bodies in patients with Parkinson's. They discovered that when α-synuclein fibrils are broken down, it often creates a smaller protein clump, which they named pα-syn* (pronounced "P-alpha-syn-star"). "Sometimes the nerve cells can efficiently degrade the α-synuclein fibrils, but if they get overwhelmed, the degradation may be incomplete," she explains. "And it turns out that the result of that partial degradation, pα-syn*, is toxic." Diego Grassi, PhD, a research associate in Lasmézas' lab, made this discovery by labelling the pα-syn* with an antibody so he could follow it throughout the cell after it was created. He observed that pα-syn* travelled and attached itself to the mitochondria. Further investigation revealed that once the pα-syn* attached, the mitochondria started to break down. These fragmented mitochondria lose their ability to carry an electrochemical signal and produce energy. The researchers followed up with an analysis of mouse and human brain samples. They confirmed the existence of pα-syn* in the dopamine-producing neurons. "The Lewy bodies are big aggregates and they're sitting in the cell, but they don't come into direct contact with the mitochondria in the way pα-syn* does," Lasmézas explains. "With Diego's discovery, we've made a direct connection between the protein α-synuclein and the downstream effects that are observed when brain cells become damaged in Parkinson's." Lasmézas plans to continue studying the connection between misfolded proteins and the destruction of mitochondria in neurons. "What we found may not be the only mechanism of toxicity, but we know it's important," she says. "This paper is about identifying where pα-syn* comes from and what it does to the mitochondria, but there's obviously, mechanistically, a lot that we still don't know." She says that these findings also have implications for

designing treatments for Parkinson's, noting that some drugs currently under development are focused on getting rid of larger fibrils that make up Lewy bodies. "It's important to be aware that when Lewy bodies are broken down, these toxic substances may be created," Lasmézas says. In addition, she adds, the discovery of pα-syn* as an important component of the disease process points to a new target for creating drugs slowing disease progression.

Medical Xpress, 5 March 2018

http://medicalxpress.com

Don't talk and drive: Examination of nearly 100 prior studies on cell phone use in cars underscores hazards

2018-03-07

In their detailed analysis of dozens of empirical studies on the effects of talking while driving, human factors researchers have provided a comprehensive and credible basis for governments seeking to enact legislation restricting drivers' use of cell phones. The analysis, just published in Human Factors: The Journal of the Human Factors and Ergonomics Society, is titled "Does Talking on a Cell Phone, With a Passenger, or Dialling Affect Driving Performance? An Updated Systematic Review and Meta-Analysis of Experimental Studies." Author Jeff Caird, a professor in psychology and community health sciences at the University of Calgary, notes that the number of studies on cell phones and driving has more than tripled since the last meta-analysis was conducted in 2008. He and co-authors Sarah Simmons, Katelyn Wiley, Kate Johnston, and William Horrey aimed to update and extend the reliability and validity of the previous conclusions. They examined 93 studies that were published between 1991 and 2015 and measured the effects of cell phone use on driving. The overall sample had 4,382 participants, with drivers' ages ranging from 14 to 84 years. The studies measured variables such as drivers' reaction time to hazards or emergency events, stimulus detection, lane positioning, speed, eye movements, and collisions. Overall, the studies concluded that speaking on both handheld and hands-free phones negatively impacted driving performance, and drivers who engaged in conversation with their passengers experienced similar negative effects. Moreover, dialling, like texting, requires drivers to look away from the road for an extended period and can result in even greater detriments to driving performance than conversation alone. "Driving is a distraction from everyday distractions such as cell phones," Caird notes.

In their detailed analysis of dozens of empirical studies on the effects of talking while driving, human factors researchers have provided a comprehensive and credible basis for governments seeking to enact legislation restricting drivers' use of cell phones.

Curiosities

"The technological solution of driverless vehicles will allow us to get back to our preferred distractions. Until then..."

Phys.org, 5 March 2018

http://phys.org

Cancer claim for Monsanto's Roundup gets judge's scrutiny

2018-03-07

Claims that the active ingredient in the widely used weed killer Roundup can cause cancer have been evaluated by international agencies, United States. and foreign regulators and the product's manufacturer—agribusiness giant Monsanto. Now, a federal judge in San Francisco is conducting his own review during an unusual set of court hearings that began Monday. It has big stakes for Monsanto and hundreds of farmers and others who have sued the company. U.S. District Judge Vince Chhabria will spend a week hearing from experts to help decide whether there is valid scientific evidence to support the lawsuits' claim that exposure to Roundup can cause non-Hodgkin's lymphoma. Chhabria is presiding over more than 300 lawsuits against Monsanto Co. by cancer victims and their families who say the company long knew about Roundup's cancer risk but failed to warn them. The plaintiffs must first persuade Chhabria, however, that he should allow their epidemiologists and other doctors to testify to a jury that Roundup can cause cancer. Many regulators have rejected the link, and Monsanto vehemently denies it and says hundreds of studies have found glyphosate—Roundup's active ingredient—is safe. The plantiffs' first witness was Beate Ritz, an epidemiologist at the University of California, Los Angeles who studies the effects of pesticide exposure. She explained some of the studies she relied on for her conclusion that there is a higher risk of non-Hodgkin's lymphoma for people exposed to glyphosate-based formulations. Chhabria will not determine if the cancer connection exists, but whether the claim has been tested, reviewed and published and is widely accepted in the scientific community. "It's game over for the plaintiffs if they can't get over this hurdle," said David Levine, an expert in federal court procedure at the University of California, Hastings College of the Law. Monsanto developed glyphosate in the 1970s, and the weed killer is now sold in more than 160 countries. Farmers in California use it on more than 200 types of crops. Homeowners use it to keep their lawns and gardens pristine. St. Louis-based Monsanto also sells seeds genetically modified to produce crops that can tolerate being sprayed with glyphosate as the surrounding weeds die. But the

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herbicide came under increasing scrutiny after the International Agency for Research on Cancer, based in Lyon, France—part of the World Health Organization—classified it as a "probable human carcinogen" in 2015. A flurry of lawsuits against Monsanto in federal and states courts followed, and California added glyphosate to its list of chemicals known to cause cancer. Christine Sheppard, among those suing Monsanto, said she sprayed Roundup for years to control weeds on her Hawaii coffee farm. In 2003, she was diagnosed with non-Hodgkin's lymphoma and given six months to live. Now 68, she is in remission but experiences severe pain in her hands and legs from her cancer treatment and has a weak immune system. She believes Roundup is to blame. "The thing that really gets to me right now is when I walk into Home Depot and places like that and see Roundup still for sale, still advertised as the best thing people can use," said Sheppard, who now lives near San Diego. Monsanto has attacked the international research agency's opinion as an outlier. The U.S. Environmental Protection Agency says glyphosate is safe for humans when used in accordance with label directions. A draft report by the agency last year concluded the herbicide is not likely to be carcinogenic to humans. The report noted science reviews by numerous other countries as well as a 2017 National Institute of Health survey had reached the same conclusion. "There are more than 800 published studies—scientific, medical and peer-reviewed—which demonstrate that glyphosate is safe and there is no association whatsoever with any form of cancer," said Scott Partridge, vice president of strategy at Monsanto. A federal judge in Sacramento last week blocked California from requiring that Roundup carry a label stating that it is known to cause cancer, saying the warning is misleading because almost all regulators have concluded there is no evidence glyphosate is a carcinogen. Timothy Litzenburg, an attorney for the plaintiffs, said the connection between glyphosate and cancer is not "junk science." "You can just do a literature search and find many, many peer-reviewed, published articles concluding that glyphosate exposure increases the risk of non-Hodgkin's lymphoma," he said.

Phys.org, 5 March 2018

http://phys.org

Volatile organic compounds in faeces tied to diet response

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Faecal levels of volatile organic compounds (VOCs) are associated with response to dietary intervention in patients with irritable bowel syndrome

Faecal levels of volatile organic compounds (VOCs) are associated with response to dietary intervention in patients with irritable bowel syndrome (IBS), according to a study published in the March issue of Clinical Gastroenterology and Hepatology.

(IBS), according to a study published in the March issue of Clinical Gastroenterology and Hepatology. Megan Rossi, Ph.D., from King's College London, and colleagues investigated whether faecal levels of VOCs were associated with response to dietary interventions (a diet low in fructans, galacto-oligosaccharides, lactose, fructose, and polyols [low-FODMAP]) in 46 patients with IBS compared to 47 IBS patients on a sham diet. Patients from each group were also given either a multistrain probiotic or a placebo supplement. The researchers found that more patients responded to the low-FODMAP diet versus the sham diet (80 versus 45 percent), but there was no significant difference in response between patients given the probiotic or the placebo supplement. There was no interaction between the diet and supplement interventions. VOC profiles at baseline contained 15 features that categorized response to the low-FODMAP diet with a mean accuracy of 97 percent, and 10 features that classified response to probiotics with a mean accuracy of 89 percent. Similar predictive powers and accuracies were seen with end-of-treatment models. "Faecal VOC profiling is a low-cost, non-invasive tool that might be used to predict responses of patients with IBS to low-FODMAP diet and probiotics and identify their mechanisms of action," the authors write. Two study authors are co-inventors of a mobile application for the low-FODMAP diet.

Medical Xpress, 5 March 2018

http://medicalxpress.com

Vaping may help pneumonia-causing bacteria invade airways

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People who smoke e-cigarettes might have an increased risk of developing pneumonia because the vapor could help bacteria stick to cells lining the airways, a small experiment suggests.

People who smoke e-cigarettes might have an increased risk of developing pneumonia because the vapor could help bacteria stick to cells lining the airways, a small experiment suggests. Traditional cigarettes have long been linked to an increased risk of pneumonia, but it's been less clear whether e-cigarettes might have the same effect. To find out, researchers did a series of laboratory experiments to see whether exposure to e-cigarette vapor might increase levels of a molecule produced by airway lining cells, called platelet-activating factor receptor (PAFR). Pneumococcal bacteria use PAFR to help them adhere to airway cells. First, the researchers exposed some human airway epithelial cells in culture dishes to e-cigarette vapor. Compared to cells that weren't exposed, those that were had PAFR levels three times higher. Then, they exposed mice to e-cigarette vapor and found higher PAFR production in the rodents who inhaled the fumes. Finally, the researchers asked 17

people who were regular vapers to come smoke an e-cigarette in the lab. Compared with these participants' PAFR levels measured before the vaping session, there was a three-fold increase in PAFR levels an hour after people smoked e-cigarettes. "The take-home message is that it is over-optimistic to assume that all of the adverse effects of cigarette smoking are reduced by switching to vaping," said senior study author Jonathan Grigg of Queen Mary University of London. "It also raises the question that, even if we have not proved that vaping increases the risk of pneumonia, for young people taking up vaping for the first time, a precautionary approach would suggest that the risk should be assumed to exist until proved otherwise," Grigg said by email. Big U.S. tobacco companies are all developing e-cigarettes. The battery-powered gadgets feature a glowing tip and a heating element that turns liquid nicotine and flavourings into a cloud of vapor that users inhale. Even when e-liquids don't contain nicotine, the lungs are still exposed to flavouring chemicals when the e-liquids are heated and the vapours are inhaled. Some previous research, mostly in lab experiments, has linked exposure to these flavourings to an increase in biomarkers for inflammation and tissue damage.
This type of cell damage can lead to lung problems including fibrosis, chronic obstructive pulmonary disorder and asthma. In the current lab experiment, PAFR levels surged in human nose lining cells in culture dishes exposed to e-liquids with nicotine and in cells exposed to nicotine-free vapor. This was accompanied by increased adhesion by pneumonia-causing bacteria. Even though the study is small and the results must be verified in larger human trials, the findings still suggest that e-cigarettes aren't risk-free and shouldn't necessarily be considered a safe way for people to try to curb use of traditional cigarettes, the researchers conclude in the European Respiratory Journal. At least when it comes to pneumonia, nicotine patches or gum may be a safer option for smoking cessation, the researchers note. "PAFR expression is enhanced in cigarette smokers and patients with chronic obstructive pulmonary disorder and has been hypothesized to be mediating enhanced adhesion of bacteria to epithelial cells and subsequent development of pneumonia," said Ilona Jaspers, deputy director of the Centre for Environmental Medicine, Asthma & Lung Biology at the University of North Carolina at Chapel Hill. "The data shown here suggest that vaping e-cigarettes could also increase expression of PAFR in relevant epithelial cells," Jaspers, who wasn't involved in the study, said by email. "In general, I would refrain from calling e-cigarettes 'safer'

than cigarettes but would suggest calling them causing 'different' effects than cigarettes."

Reuters Health, 1 March 2018

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

Holding hands can sync brainwaves, ease pain, study shows

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Reach for the hand of a loved one in pain and not only will your breathing and heart rate synchronise with theirs, your brain wave patterns will couple up too, according to a study published this week in the Proceedings of the National Academy of Sciences (PNAS). The study, by researchers with the University of Colorado Boulder and University of Haifa, also found that the more empathy a comforting partner feels for a partner in pain, the more their brainwaves fall into sync. And the more those brain waves sync, the more the pain goes away. "We have developed a lot of ways to communicate in the modern world and we have fewer physical interactions," said lead author Pavel Goldstein, a postdoctoral pain researcher in the Cognitive and Affective Neuroscience Lab at CU Boulder. "This paper illustrates the power and importance of human touch." The study is the latest in a growing body of research exploring a phenomenon known as "interpersonal synchronisation," in which people physiologically mirror the people they are with. It is the first to look at brain wave synchronisation in the context of pain and offers new insight into the role brain-to-brain coupling may play in touch-induced analgesia, or healing touch. Goldstein came up with the experiment after, during the delivery of his daughter, he discovered that when he held his wife's hand, it eased her pain. "I wanted to test it out in the lab: Can one really decrease pain with touch, and if so, how?" He and his colleagues at University of Haifa recruited 22 heterosexual couples, age 23 to 32 who had been together for at least one year and put them through several two-minute scenarios as electroencephalography (EEG) caps measured their brainwave activity. The scenarios included sitting together not touching; sitting together holding hands; and sitting in separate rooms. Then they repeated the scenarios as the woman was subjected to mild heat pain on her arm. Merely being in each other's presence, with or without touch, was associated with some brain wave synchronicity in the alpha mu band, a wavelength associated with focused attention. If they held hands while she was in pain, the coupling increased the most. Researchers also found that when she was in pain and he couldn't touch her, the coupling of their brain waves

A new study by a pain researcher shows that when a romantic partner holds hands with a partner in pain, their brain waves sync and her pain subsides.

diminished. This matched the findings from a previously published paper from the same experiment which found that heart rate and respiratory synchronization disappeared when the male study participant couldn't hold her hand to ease her pain. "It appears that pain totally interrupts this interpersonal synchronization between couples and touch brings it back," says Goldstein. Subsequent tests of the male partner's level of empathy revealed that the more empathetic he was to her pain the more their brain activity synced. The more synchronized their brains, the more her pain subsided. How exactly could coupling of brain activity with an empathetic partner kill pain? More studies are needed to find out, stressed Goldstein. But he and his co-authors offer a few possible explanations. Empathetic touch can make a person feel understood, which in turn -- according to previous studies -- could activate pain-killing reward mechanisms in the brain. "Interpersonal touch may blur the borders between self and other," the researchers wrote. The study did not explore whether the same effect would occur with same-sex couples, or what happens in other kinds of relationships. The takeaway for now, Pavel said: Don't underestimate the power of a hand-hold. "You may express empathy for a partner's pain, but without touch it may not be fully communicated," he said.

Science Daily, 1 march 2018

http://www.sciencedaily.com

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