Bulletin Board

JUN. 21, 2019

CHEMWATCH

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ASIA PACIFIC

Glyphosate use in Australia

2019-06-13

The Australian Pesticides and Veterinary Medicine Authority (APVMA) continues to actively monitor any new scientific information about glyphosate and currently remain satisfied that APVMA approved products containing glyphosate can continue to be used safely according to label directions. The APVMA's position on glyphosate is aligned with other international regulators and the Joint FAO/WHO Meeting on Pesticide Residues, including recent comprehensive reviews of glyphosate conducted by the USA and Canada. Further information is available at: Read more

APVMA Regulatory Update, 13 June 2019

http://www.apvma.gov.au

The Australian Pesticides and Veterinary Medicine Authority (APVMA) continues to actively monitor any new scientific information about glyphosate and currently remain satisfied that APVMA approved products containing glyphosate can continue to be used safely according to label directions.

Sunscreen manufacturing: Demonstrating compliance with the PIC/S guide to GMP, PE009-13

2019-06-13

The Therapeutic Goods Administration (TGA) has released guidance for sunscreen manufacturers who must comply with the PIC/S Guide to Good Manufacturing Practice for Medicinal Products. In Australia, many sunscreens are regulated as therapeutic goods because of their important role addressing public health issues. As such they must comply with the Therapeutic Goods Act 1989, the Therapeutic Goods Regulations 1990 and any other relevant regulatory requirements. Sunscreens that are regulated as therapeutic goods under the Therapeutic Goods Act 1989 are referred to as 'therapeutic sunscreens'. Included in this category are:

- primary sunscreens with SPF 4 or more
- secondary sunscreens - except those regulated as cosmetics
- primary or secondary sunscreens with SPF 4 or more that contain an insect repellent

sunscreens with SPF less than 4 that are exempt from being listed under the Therapeutic Goods Act 1989 because they come within the exemption in Item 8(g) of Schedule 5 of the Therapeutic Goods Regulations 1990. Details on the therapeutic sunscreen regulatory framework are available at Australian Regulatory Guidelines for Sunscreens. To be listed on the ARTG, sunscreens must comply with the Australian and New Zealand

sunscreen standard AS/NZS 2604:2012 Sunscreen products-Evaluation and classification.

TGA, 11 June 2019

http://www.tga.gov.au/

Application to introduce fungicide Amicus to New Zealand

2019-06-13

New Zealand's Environmental Protection Authority (EPA) are seeking comments on an application to introduce the fungicide Amicus to New Zealand. The applicant, Nufarm, is seeking approval to import or manufacture Amicus as a novel fungicide for the control of the diseases club root in transplanted brassica crops and powdery scab in potatoes. The active ingredient in Amicus, amisulbrom, is new to New Zealand, and is applied to brassicas as a pre-plant seedling drench and to potatoes as an in-furrow spray. The application proposes that while there are some risks associated with AMICUS, these can be managed and mitigated by following use instructions. Nufarm says this substance would provide a beneficial tool for the horticultural industry in disease control and resistance management. This application is being publicly notified to enable people to provide EPA with information they believe the agency should be aware of, such as beneficial or adverse effects additional to those the applicant has described. Submissions close at 5pm on 19 July 2019. Further information on the consultation is available at: Visit the consultations page for more information.

New Zealand's Environmental Protection Authority (EPA) are seeking comments on an application to introduce the fungicide Amicus to New Zealand.

NZ EPA, 10 June 2019

http://www.epa.govt.nz

SAMR Issued a Draft on 17 New Excipients for Health Food Filing

2019-06-13

On 4 June, 2019, China's State Administration for Market Regulation (SAMR) issued a Notice on the Supplement List of Available Excipients for Heath Food Filing (1) for public comments. Opinions and advice shall be given before 30 June, 2019. The drafted Supplement List includes 3 aspects:

Regulatory Update

1. Newly added excipients: including 17 new excipients such as soybean lecithin, curcumin, fruit and vegetable powder, etc.
2. Supplement product standards for current excipients: add more suitable standards for current 24 kinds of excipients, such as D-mannitol, titanium dioxide, maltodextrin.
3. Update the Chinese Pharmacopoeia version in current excipient list.

Among them, the most striking part is the 17 newly added excipients. When they are officially approved, enterprises can get more choices for the production of filing products. Please refer to below table for more detailed information.

17 newly added excipients and their maximum dosage

S.N.	Excipient name	Maximum dosage	
		Solid preparation	Liquid preparation
1	Menthol	Appropriate level as required for flavouring	
2	Galacto-oligosaccharide	Appropriate level as required for condiment	
3	Fructo-oligosaccharide	Appropriate level as required for condiment	
4	Isomaltooligosaccharide	Appropriate level as required for condiment	
5	Edible sweet potato starch	Appropriate level	Appropriate level
6	Magnesium carbonate	It is unavailable for products supplementing Mg or products targeted for 1-3 years old; Other products: ≤0.8g per day (count as Mg).	
7	Citric Acid	Appropriate level	Appropriate level
8	Anhydrous citric acid	Appropriate level	Appropriate level
9	phospholipid	Appropriate level as required for emulsifier, solubilizer	
10	Concentrated soybean lecithin	Appropriate level as required for emulsifier, solubilizer	
11	Soybean lecithin powder	Appropriate level as required for emulsifier, solubilizer	
12	Fractionated soybean lecithin	Appropriate level as required for emulsifier, solubilizer	
13	Transparent soybean lecithin	Appropriate level as required for emulsifier, solubilizer	

14	Soybean lecithin	Appropriate level as required for emulsifier, solubilizer
15	Octyl and decyl glycerate	Appropriate level as required for emulsifier
16	Curcumin	Appropriate level as required for colouring, ≤0.7g/kg
17	Fruit and vegetable powder (the specific name shall be clearly defined)	Appropriate level as required for condiment

Further information is available at: SAMR Notice

CIRS, 5 June 2019

http://www.cirs-reach.com

Notice on Request for Comments on the Recommended National Standard "Technical Requirements for Low Volatile Organic Compound Content Coating Products"

2019-06-13

China's NCIA released a new draft of Technical Requirement for Low VOC Content Coatings Product and sought feedback from the public. The limits of the VOC content in water-based coatings, solvent-based coatings, solventless coatings and radiation curable coatings are stipulated in the draft. The national standard "Technical Requirements for Low VOC Content Coating Products", which was developed by the Environmental Planning Institute of the Ministry of Ecology and Environment, China Coatings Industry Association and CNOOC Changzhou Coatings and Chemicals Research Institute, has completed the preparation of the standard consultation draft. Further information on the technical requirement is available at:

China's NCIA released a new draft of Technical Requirement for Low VOC Content Coatings Product and sought feedback from the public.

- Annex 1 Technical Requirements for Low Volatile Organic Compound Content Coating Products - Consultation Draft.pdf
- Annex 2 "Technical Requirements for Low VOC Content Coating Products" Preparation Instructions.pdf
- Annex 3 "Technical Requirements for Low Volatile Organic Compound Content Coating Products" Verification Data Classification Summary.pdf

- Annex 4 Standard Feedback Form.docx

NCIA, 30 May 2019

http://www.chinacoatingnet.com

Revised Rules and Regulations on Electronic Nicotine and Non- Nicotine Delivery System

2019-06-13

E-cigarettes, including both Electronic nicotine and non-nicotine delivery systems (ENDS/ENNDS), are used to deliver aerosolised solutions to the lungs, which is similar to the act of smoking. At present, the industry is commonly marketing ENDS/ENNDS as a "safer" or "less harmful" alternative to conventional tobacco products despite the significant level of uncertainty surrounding its safety. The available studies are not enough to clearly and unequivocally conclude that the long-term use of ENDS/ENNDS will not have any harmful effect to human health. There may still be undue harm to health that may be brought about by the use of these products thus, precautionary measures such as regulation by a competent authority is necessary for the protection of public health. Thus, the DOH recognises the exigency to strengthen its policy for the effective regulation of ENDS/ENNDS products.

Further information on the new requirements is available at: https://images.chemycal.com/Media/Files/TBT/19_3382_00_e.pdf

Chemycal, 11 June 2019

http://chemycal.com

The Philippines Department of Health has published revised rules and regulations on electronic nicotine and non-nicotine delivery systems.

AMERICA

US EPA chief narrows advisers' focus to one part of controversial plan to limit data used for regulation

2019-06-13

Experts on the Environmental Protection Agency's Science Advisory Board (SAB) want to provide detailed feedback on the EPA's sweeping proposal to restrict the scientific data it considers when crafting regulations. But EPA administrator Andrew Wheeler made it clear 5 June that he wants the SAB to give advice primarily on a single provision in that plan. Scientists from industry, state governments, and lobbying groups that serve on the SAB asked the agency in 2018 not to finalise the plan containing "a myriad of

scientific issues" until after they reviewed it. The proposal would force the EPA to use only publicly available data as the basis for regulations such as water pollution limits and controls on commercial chemicals. Many science groups say the plan could lead the EPA to ignore valid scientific evidence. Speaking in person to the SAB in Washington, DC, Wheeler rejected the board's request because the review could take months. He asked the board to focus specifically on how the agency can protect confidential business and personally identifying information while providing public access to these data. Wheeler wants the SAB's advice on this issue by the end of the summer. He did not rule out individual feedback from SAB members on other provisions in the proposal, which EPA intends to finalise by the end of 2019. The EPA chief told the SAB that the agency is transitioning to a new practice for getting scientific and technical advice from its science advisers more quickly. "It's no secret the process was broken," Wheeler said. For instance, reviews of thorny scientific issues have delayed completion of chemical hazard assessments for the agency's Integrated Risk Information System, he said.

Chemical & Engineering News, 6 June 2019

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

FDA Issues Final Rule on Consumer Hand Sanitisers

2019-06-13

On 12 April 2019, the United States Food and Drug Administration (FDA) issued a final rule on hand sanitisers available over-the-counter (OTC).

On 12 April 2019, the United States Food and Drug Administration (FDA) issued a final rule on hand sanitisers available over-the-counter (OTC). The final rule applies to active ingredients used in consumer antiseptic rub products sometimes also known as rubs, leave-on products, or hand 'sanitisers', as well as antiseptic wipes. These products are intended to be used when soap and water are not available and are left on and not rinsed off with water. The final rule also seeks to ensure that the agency's safety and effectiveness evaluations and determinations for consumer antiseptic rub active ingredients are consistent, up-to-date and appropriately reflect current scientific knowledge and increasing use patterns. "Our action today aims to help provide consumers with confidence that the over-the-counter hand sanitisers they're using are safe and effective when they don't have access to water to wash with soap," said Janet Woodcock, M.D., director of the FDA's Centre for Drug Evaluation and Research. "In today's final regulation we finalised the FDA's previous determination that 28 active ingredients, including triclosan and benzethonium chloride, are not eligible for evaluation under the FDA's OTC Drug Review for use in consumer antiseptic rubs." Requests were

made that benzalkonium chloride, ethyl alcohol, and isopropyl alcohol be deferred from consideration in this consumer antiseptic rub document to allow more time for interested parties to complete necessary studies to fill the safety and effectiveness data gaps identified in the 2016 Consumer Antiseptic Rub proposed rule for these ingredients. For each active ingredient, FDA has deferred rulemaking for 1 year, with the possibility of renewal, which allows the Agency to monitor the continued progress of the studies being conducted. Consumer antiseptic hand sanitisers provide a convenient alternative when hand washing with plain soap and water is unavailable, said FDA. Millions of Americans use antiseptic rubs daily, sometimes multiple times a day, to help reduce bacteria on their hands. The Centres for Disease Control and Prevention, (CDC), advises that washing hands with plain soap and running water is one of the most important steps consumers can take to avoid getting sick and to prevent spreading infections to others. If soap and water are not available, the CDC recommends using an alcohol-based hand sanitizer that contains at least 60 percent alcohol. The effective date of the final rule is 13 April 2020. Further information is available at: "Safety and Effectiveness of Consumer Antiseptic Rubs; Topical Antimicrobial Drug Products for Over-the-Counter Human Use"

Product Supply Chain Intelligence, 31 May 2019

https://psi.ul.com/en

DOE Proposes to Redefine High-Level Radioactive Waste

2019-06-13

On 5 June, the United States Department of Energy published a Supplemental Notice Concerning U.S. Department of Energy Interpretation of High-Level Radioactive Waste, saying that it now interprets the statutory term "high-level radioactive waste" as set forth in the Atomic Energy Act of 1954, as amended (AEA), and the Nuclear Waste Policy Act of 1982, as amended (NWPA), so that some reprocessing wastes may be classified as non-HLW and may be disposed of in accordance with its radiological characteristics. The agency also published a notice June 5 that it will be drafting an Environmental Assessment, a form of National Environmental Policy Act of 1969 analysis, on a plan to dispose up to 10,000 gallons of stabilised (grouted) Defence Waste Processing Facility recycle wastewater from the Savannah River Site at a commercial low-level radioactive waste disposal facility located outside South Carolina and licensed by either the Nuclear Regulatory Commission or an Agreement

According to the U.S Department of Energy, the revised interpretation, "if implemented through subsequent actions," could provide a range of benefits to both DOE and the public.

Regulatory Update

State. DOE had proposed the new interpretation in October 2018, asking for comments. The agency received a total of 5,555 comments, with only roughly 360 of them being distinct, unrepeated comments, from members of the public, Native American tribes, members of Congress, numerous state and local governments, and the Nuclear Regulatory Commission. DOE said it has not made, and does not presently propose, any changes or revisions to current policies, legal requirements, or agreements with respect to HLW, and decisions about whether and how this interpretation of HLW will apply to existing wastes and whether such wastes may be managed as non-HLW will be the subject of subsequent actions. The AEA and NWPA define "high-level radioactive waste" as: (A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (B) other highly radioactive material that the NRC, consistent with existing law, determines by rule requires permanent isolation. DOE's revised interpretation of the statutes provides that a reprocessing waste may be determined to be non-HLW if the waste meets either of the following two criteria: 1) does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations, and meets the performance objectives of a disposal facility; or 2) does not require disposal in a deep geologic repository and meets the performance objectives of a disposal facility as demonstrated through a performance assessment conducted in accordance with applicable requirements. According to DOE, the revised interpretation, "if implemented through subsequent actions," could provide a range of benefits to both DOE and the public, including these:

- Reducing the length of time that radioactive waste is stored on site at DOE facilities, increasing safety for workers, the public, and the environment
- Removing reprocessing waste from the states where it has been stored for decades and providing for the disposal of these wastes in facilities constructed and regulated for such purposes
- Enhancing safety at DOE sites by using lower-complexity waste treatment and immobilisation approaches
- Aligning the United States with international guidelines for management and disposal of radioactive waste based on radiological risk

- Utilising mature and available commercial facilities and capabilities to shorten mission completion schedules and reduce taxpayer financial liability

Environmental Protection News, 5 June 2019

http://www.eponline.com

California: Senate Advances "Baseline" Bill Intended to Compensate for "Roll-Backs" of Federal Environmental and Safety Standards

2019-06-13

Recently, California's legislature advanced Senate Bill ("SB" or "Bill") SB-1 to the Assembly. The Bill is intended to ensure that California's health and safety standards remain as rigorous as those in place on 17 January 2017, during the Obama Administration. SB-1 would require state agencies to monitor various federal standards and amend California's standards to remain as stringent as the Obama-Era "baseline" when federal roll-backs under the current Administration occur. It would also allow citizens to file suit to enforce "baseline" federal and state standards if such standards are weakened.

Recently, California's legislature advanced Senate Bill ("SB" or "Bill") SB-1 to the Assembly.

National Law Review, 12 June 2019

http://www.natlawreview.com

EUROPE

ANSES recommends restricting persulphates in hair products

2019-06-13

French Agency for Food, Environmental and Occupational Health & Safety (ANSES) is publishing its expert appraisal work on ammonium persulphate, potassium persulphate and sodium persulphate substances used mainly in hair bleaching products. The Agency has concluded that the use of persulphates poses health risks to hairdressing professionals and consumers, as these sensitising substances cause allergic respiratory and skin reactions. In view of the reported effects and disorders, ANSES recommends that exposure of professionals and the general public to products containing persulphates be reduced to a minimum. Ammonium, potassium and sodium persulphates are substances used for their

oxidising properties, particularly in hair bleaching products. They have been classified as respiratory and skin sensitisers in the European CLP Regulation, and are the second leading cause of occupational asthma related to chemical exposure, after quaternary ammonium. The Agency's expert appraisal work, carried out as part of its mandate to implement the REACH Regulation, determined the risks for professionals and consumers associated with these sensitising substances, and identified the management measures to be implemented.

Health risks for hairdressing professionals and consumers

The work carried out by ANSES has demonstrated health risks for hairdressing professionals and consumers when these substances are used as ingredients in hair products. Persulphate substances are used in different forms in hair bleaching products: powders to be mixed in a liquid, granules, creams, and ready-to-use liquids. Occupational exposure occurs by the respiratory and dermal routes, mainly during the preparation, application and rinsing of these products. Consumers can also be exposed, either when using bleaching products designed for home use or as hair salon customers. Further information is available at: https://www.anses.fr/en/content/anses-recommends-restricting-persulphates-hair-products

Chemycal, 12 June 2019

http://chemycal.com

Draft Commission Regulation amending and correcting Annexes II, III and V to Regulation (EC) No 1223/2009 on cosmetic products

2019-06-13

The European Commission has published a draft Regulation, which aims at prohibiting or restricting the use in cosmetic products of all substances which have been classified in 2018 as carcinogenic, mutagenic or toxic for reproduction (CMR) by Commission Regulation (EU) N 2018/140 amending for the purposes of its adaptation to technical and scientific progress Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures. Further information on the draft regulations is available at:

- 19_3395_00_e.pdf

The European Commission has published a draft Regulation, which aims at prohibiting or restricting the use in cosmetic products of all substances which have been classified in 2018 as carcinogenic, mutagenic or toxic for reproduction (CMR) by Commission Regulation (EU) N 2018/140 amending for the purposes of its adaptation to technical and scientific progress Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures.

- 19_3395_01_e.pdf

Chemycal, 12 June 2019

http://chemycal.com

EFSA issues new advice on phosphates

2019-06-13

Estimated total intake of phosphates from food may exceed the safe level set by the European Food Safety Authority (EFSA) after re-evaluating their safety. EFSA's scientists also recommend the introduction of maximum permitted levels to reduce the content of phosphates when used as additives in food supplements as those who take them regularly may be at risk. Phosphates are essential nutrients (a form of phosphorus), which are present naturally in the human body and are an essential part of our diet. A group of substances commonly referred to as "phosphates" are authorised as food additives in the European Union. They are added to a wide range of foods for "technological" functions (e.g. as emulsifiers, antioxidants). Some of them can be used in foods for infants and young children.

Estimated total intake of phosphates from food may exceed the safe level set by the European Food Safety Authority (EFSA) after re-evaluating their safety.

First 'combined' safe intake for phosphates

Dr Ursula Gundert-Remy, Chair of the working group on phosphates, said: "The panel has re-assessed the safety of phosphates and derived, for the first time, a group acceptable daily intake [ADI] of 40 milligrams per kilogram of body weight [mg/kg bw] per day. "Because phosphates are also nutrients and essential to our diets, in our approach we defined an ADI which considers the likely phosphorus intake from various sources, including natural sources and food additives." The ADI corresponds to an intake of 2.8 grams of phosphorus per day for an average adult weighing 70kg. Dr Maged Younes, Chair of EFSA's expert Panel on Food Additives and Flavourings (FAF), said: "Importantly, the ADI does not apply to people with moderate to severe reduction in kidney function, which is considered a vulnerable population group. This conclusion is based on the recognised effect of high phosphate intake on the kidney."

Assessing dietary exposure

Dietary exposure was calculated from the total amount of phosphorus from all dietary sources and not limited to the levels in food additives reported by manufacturers. The experts estimated that food additives indicatively contribute between 6 to 30% of the total average intake of phosphorus. Dr Younes added: "We estimated that dietary exposure to

phosphates may exceed the new ADI for infants, toddlers and children with average consumption of phosphates in their diet. This is also the case for adolescents whose diet is high in phosphates." "The data we had did not give rise to safety concerns in infants below 16 weeks of age consuming formula and food for medical purposes containing phosphates." Existing maximum permitted levels of these additives in food range from 500 to 20,000 milligrams per kilogram (mg/kg) of food depending on the food type. EFSA's scientific advice will inform risk managers in the European Commission and Member States who regulate the safe use of phosphates as food additives in the EU.

Phosphates in food supplements

Currently phosphates as additives in food supplements can be used at quantum satis (i.e. as much as technologically needed). EFSA's experts found that for those above the age of 3 years who take such supplements regularly, estimated dietary exposure may exceed the ADI at levels associated with risks for kidney function. Dr Younes said: "Based on the exposure assessment, the panel recommends the introduction of numerical maximum permitted levels of phosphates used as additives in food supplements in place of quantum satis."

Stakeholder input

EFSA carried out a public consultation to engage with interested parties on questions in the fields of nephrology, mineral metabolism, cardiovascular and nutrition medicine relevant to the re-evaluation of phosphate food additives. EFSA's scientists considered this feedback in the preparation of this scientific opinion.

Further information is available at:

- Re-evaluation of phosphoric acid–phosphates – di-, tri- and polyphosphates (E 338–341, E 343, E 450–452) as food additives and the safety of proposed extension of use
- Outcome of the questions for health professionals in the fields of nephrology, mineral metabolism, cardiovascular and nutrition medicine on phosphates food additives re-evaluation

EFSA, 12 June 2019

http://www.efsa.europa.eu

Regulatory Update

INTERNATIONAL

2019 Updates of The Stockholm and Rotterdam Conventions

2019-06-13

The 9th meetings of the Conferences of the Parties to the Rotterdam and Stockholm Conventions (COP) were held from 29 April to 10 May 2019 in Geneva. The COP has decided to list the following new chemicals.

Convention	Updates
Stockholm Convention	2 chemicals: Dicofol(pesticide); Perfluorooctanoic acid (PFOA) its salts and PFOA-related compounds (some applications with time-limited exemptions); Listing in Annex A to the Convention obliges Parties to eliminate these chemicals from use.
Rotterdam Convention	2 chemicals phorate(pesticides); hexabromocyclododecane (an industrial chemical); Listing in annex III means that they will be subject to the prior informed consent (PIC) procedure.

The 9th meetings of the Conferences of the Parties to the Rotterdam and Stockholm Conventions (COP) were held from 29 April to 10 May 2019 in Geneva.

Whether to list the following chemicals under the Rotterdam Convention will be postponed to the COP meeting in May 2021.

- Paraquat formulations of type SL/EC containing ≥200 g paraquat ion per L;
- Fenthion formulations of type ULV containing ≥640 g fenthion per L;
- Carbosulfan;
- Acetochlor;
- Chrysotile asbestos

Impacts of the Stockholm Convention

The Stockholm Convention has a big impact on both chemical industry and other sectors which supply or use listed chemicals (persistent organic pollutants) in their articles and parts. Once a hazardous substance is added to Annex A, it will face a global ban. Companies must take measures to eliminate or substitute the hazardous substance in their products.

Impacts of the Rotterdam Convention

Regulatory Update

Chemicals listed in the Rotterdam Convention are not banned. However, certain information must be exchanged between the exporting party and importing part. Prior Informed Consent (PIC) Procedure must be followed.

Further information is available at: UNEP Press Release;

Chem Safety Pro, 10 May 2019

https://www.chemsafetypro.com

REACH Update

Authorisation refused for a use of sodium dichromate

2019-06-13

The European Commission has rejected the authorisation of sodium dichromate (EC 234-190-3; CAS 7789-12-0, 10588-01-09) for a use by Hapoc GmbH & Co KG as the application was not in conformity. Further information is available at: Summary in Official Journal

ECHA News, 12 June 2019

http://echa.europa.eu

New web pages on expert group on uses and exposure

2019-06-13

The REACH Exposure Expert Group (REEG) gathers Member States and ECHA experts to discuss, collaborate and coordinate activities on use and exposure issues. The independent group supports authorities to implement the Integrated Regulatory Strategy. It also shares experiences and reflects on strategies, methods and tools for obtaining information related to use description, risk management measures and estimating exposure for hazardous substances. Further information about the group is available: REACH Exposure Expert Group

ECHA News, 12 June 2019

http://echa.europa.eu

The EC has rejected the authorisation of sodium dichromate

Restriction intentions

2019-06-13

The submission date for undecafluorohexanoic acid (PFHxA), its salts and related substances (EC -, CAS -) has been updated. The new submission date is now 20 December 2019 (previously 27 September). Further information is available at: Registry of restriction intentions until outcome

ECHA News, 12 June 2019

http://echa.europa.eu

New proposals and intentions to harmonise classification and labelling

2019-06-13

The European Chemicals Agency (ECHA) has received intentions to harmonise classification and labelling for the following substances:

- dibutyltin maleate (EC 201-077-5, CAS 78-04-6), and
- dibutyltin oxide (EC 212-449-1, CAS 818-08-6).

A new proposal has been submitted for multi-walled carbon nanotubes (fibres fulfilling the WHO definition: diameter < 3 µm, fibre length > 5 µm and aspect ratio ≥ 3:1, with a diameter > xx nm) (EC -, CAS -).

Further information is available at: Registry of CLH intentions until outcome

ECHA News, 12 June 2019

http://echa.europa.eu

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

2019-06-13

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

Metam-sodium

- Product type 9 (fibre, leather, rubber and polymerised materials preservatives)
- Product type 11 (preservatives for liquid-cooling and processing systems)

Thiram

- Product type 9 (fibre, leather, rubber and polymerised materials preservatives)

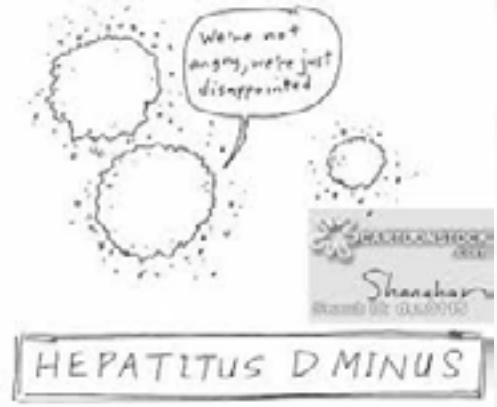
Yorda's Hive, 12 June 2019

https://www.yordasgroup.com/hive/news

Janet's Corner

Hepatitus D Minus

2019-06-12



Hazard Alert

Acetamide

2019-05-27

Acetamide (IUPAC: ethanamide) is an organic compound with the formula CH_3CONH_2. It is the simplest amide derived from acetic acid. [1] It is a colourless, deliquescent hexagonal crystal. Acetamide is odourless when pure, but frequently has a mousy odour. It is soluble in water, alcohol, chloroform, glycerol, hot benzene, and slightly soluble in ether. Acetamide is combustible and when heated to decomposition, it emits toxic fumes of oxides of nitrogen. [2]

USES [2]

Acetamide is used in organic synthesis as a reactant, a solvent, and a peroxide stabiliser. It is also used as a general solvent, a hygroscopic agent, wetting agent, penetrating agent, in lacquers, in explosives, in soldering flux, as a solubiliser, and a plasticiser. Acetamide is also used in the manufacture of methylamine and the denaturing of alcohol.

SOURCES & ROUTES OF EXPOSURE

Acetamide (IUPAC: ethanamide) is an organic compound with the formula CH3CONH2.

Sources of Exposure [3]

Occupational exposure to acetamide may occur for those workers in the plastics and chemical industries.

Routes of Exposure [2]

Probable routes of human exposure to acetamide are inhalation of vapours or dusts and dermal contact.

HEALTH EFFECTS [3]

Acute Effects

- Acetamide causes mild skin irritation in humans from acute exposure.
- Tests involving acute exposure of rats and mice have shown acetamide to have low to moderate acute toxicity from oral exposure.

Chronic Effects

- No information is available on the chronic effects of acetamide in humans or animals.
- The Reference Concentration (RfC) for acetamide is under review by EPA.

- EPA has not established a Reference Dose (RfD) for acetamide.

Reproductive/Developmental Effects

- No information is available on the reproductive or developmental effects of acetamide in humans.
- Animal studies have not reported any significant developmental effects from exposure to acetamide.

Cancer Risk

- No information is available on the carcinogenic effects of acetamide in humans.
- Animal studies have reported liver tumours from oral exposure to acetamide.
- EPA has not classified acetamide for carcinogenicity.
- The International Agency for Research on Cancer (IARC) has classified acetamide as a Group 2B, possible human carcinogen.

SAFETY [4]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.
- Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Fire & Explosion Information

- Acetamide may be combustible at high temperature.

- Products of combustion include carbon oxides (CO, CO2) and nitrogen oxides (NO, NO2).
- Dry chemical powder should be use to extinguish small fires.
- Large fires should be extinguished with water spray, fog or foam. Do not use water jet.
- Acetamide is combustible and when heated to decomposition it emits toxic fumes.

Exposure Controls & Personal Protection

Engineering Controls

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

Personal Protective Equipment

The following personal protective equipment is recommended when handling acetamide:

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

Personal protective equipment in case of a large spill:

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

Hazard Alert

REGULATION

No occupational exposure limits have been set for acetamide. However, it may pose a health risk. Safe work practices should be followed when handling this substance.

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Gossip

How a member of a family of light-sensitive proteins adjusts skin colour

2019-05-28

A team of Brown University researchers found that opsin 3 -- a protein closely related to rhodopsin, the protein that enables low-light vision -- has a role in adjusting the amount of pigment produced in human skin, a determinant of skin colour. When humans spend time in the sun without proper skin protection, the sun's ultraviolet (UV) radiation signals the skin to produce more melanin -- which protects against the cancer-causing effects of the radiation -- and become darker. There are two parts to solar UV radiation: short wavelength radiation or UVB, and long wavelength radiation or UVA. Each part is detected by the skin in different ways; how UVB makes humans tan has been known for a while. On the other hand, scientists know less about how skin detects and responds to UVA, the more abundant kind of solar UV radiation. Elena Oancea, an associate professor in the department of Molecular Pharmacology, Physiology and Biotechnology at Brown, has been studying precisely this question. In 2015, when her team uncovered the first clues to indicate that melanocytes, specialised skin cells that produce the pigment melanin, have an abundance of opsin 3, they thought that opsin 3 might be the receptor that detects UVA and signals increased melanin production. Four years and four major surprises later, the team's findings were published on in the journal Proceedings of the National Academy of Sciences. "We've found the role of opsin 3 in human melanocytes and figured out the molecular steps that allow opsin 3 to achieve this function," Oancea said. "Opsin 3 modulates how much pigment the cells make, but, surprisingly, it does so independent of light. This mechanism is a new paradigm for opsins. Once we learn more about opsin 3, it may be a good target for treating pigmentation disorders." Armed with their initial hypothesis that opsin 3 detects UVA radiation, causing calcium ions to flood the melanocytes and triggering melanin production, the team jumped into experiments. Rana Ozdeslik, a doctoral student who earned her Ph.D. from Brown in 2017 and continued work on the project as a research associate, used a genetic engineering tool to greatly reduce the amount of opsin 3 in cultured human melanocytes. When Ozdeslik exposed the skin cells with almost no opsin 3 to UV light, they still produced a burst of calcium ions. Their initial hypothesis was wrong. "Our first big surprise was that opsin 3 is not the UVA detector," Oancea said. As the team planned next steps, Ozdeslik observed that the skin cells without opsin 3 appeared much darker, Oancea said. This was the second surprise. Indeed, when they measured melanin, the melanocytes made more pigment in the

After a series of surprising discoveries, a team of scientists determined a role of opsin 3 in tuning human skin colour in response to ultraviolet rays

absence of opsin 3. The next step was to figure out how. At that point in the research process, Brown doctoral student Lauren Olinski joined the team. Together, they found that opsin 3 changes the activity of the melanocortin-1 receptor, a protein known to increase synthesis of cyclic adenosine monophosphate (cAMP), a molecular signal that triggers melanin production. Opsin 3 regulates melanin by decreasing the levels of cAMP produced by the melanocortin-1 receptor. This was the third surprise of the project. The team determined that, as expected, opsin 3 binds retinal, a form of vitamin A that is essential for sensing light in all rhodopsin-related proteins. However, they could not detect opsin 3 absorbing any wavelength of light. This was their fourth surprise and one that Oancea still finds quite puzzling. She said it is possible that the retinal serves some kind of structural purpose or that opsin 3 absorbs light in a wavelength range that cannot be easily measured. Ultimately, the team determined that opsin 3 decreases melanin production in skin cells by decreasing the levels of an important molecular signal -- but that this regulation does not seem to be triggered by light. Now that they have determined opsin 3's role in skin pigmentation, the team is seeking to learn in what other parts of the body opsin 3 is produced and what kind of functions it might have. Olinski is working to determine where and how opsin 3 works in the brain, where it was first discovered. The finding that opsin 3 can adjust how much pigment melanocytes make suggests that opsin 3 could be a target for treating pigmentation disorders. Hyperpigmentation disorders are characterised by too much melanin; hypopigmentation disorders, such as albinism, are characterised by too little melanin, which greatly increases the patients' sensitivity to solar UV radiation and susceptibility to skin cancer. Most pigmentation disorders have no available treatments. Before scientists will be able to target opsin 3 in skin, they need to understand what it does in other parts of the body and learn how to turn its activity on or off, Oancea said.

EurekAlert, 16 May 2019

http://www.eurekalert.org

New way to beat the heat in electronics

2019-05-28

A nanocomposite invented at Rice University's Brown School of Engineering promises to be a superior high-temperature dielectric material for flexible electronics, energy storage and electric devices. The nanocomposite combines one-dimensional polymer nanofibers and two-dimensional boron nitride nanosheets. The nanofibers reinforce the

Rice University lab's flexible insulator offers high strength and superior thermal conduction

self-assembling material while the "white graphene" nanosheets provide a thermally conductive network that allows it to withstand the heat that breaks down common dielectrics, the polarized insulators in batteries and other devices that separate positive and negative electrodes. The discovery by the lab of Rice materials scientist Pulickel Ajayan is detailed in Advanced Functional Materials. Research scientist M.M. Rahman and postdoctoral researcher Anand Puthirath of the Ajayan lab led the study to meet the challenge posed by next-generation electronics: Dielectrics must be thin, tough, flexible and able to withstand harsh environments. "Ceramic is a very good dielectric, but it is mechanically brittle," Rahman said of the common material. "On the other hand, polymer is a good dielectric with good mechanical properties, but its thermal tolerance is very low." Boron nitride is an electrical insulator, but happily disperses heat, he said. "When we combined the polymer nanofiber with boron nitride, we got a material that's mechanically exceptional, and thermally and chemically very stable," Rahman said. The 12-to-15-micron-thick material acts as an effective heat sink up to 250 degrees Celsius (482 degrees Fahrenheit), according to the researchers. Tests showed the polymer nanofibers-boron nitride combination dispersed heat four times better than the polymer alone. In its simplest form, a single layer of polyaramid nanofibers binds via van der Waals forces to a sprinkling of boron nitride flakes, 10% by weight of the final product. The flakes are just dense enough to form a heat-dissipating network that still allows the composite to retain its flexibility, and even foldability, while maintaining its robustness. Layering polyaramid and boron nitride can make the material thicker while still retaining flexibility, according to the researchers. "The 1D polyaramid nanofiber has many interesting properties except thermal conductivity," Rahman said. "And boron nitride is a very interesting 2D material right now. They both have different independent properties, but when they are together, they make something very unique." Rahman said the material is scalable and should be easy to incorporate into manufacturing.

EurekAlert, 16 May 2019

http://www.eurekalert.org

Self-repairing batteries would have longer lifetimes than batteries at present.

Self-repairing batteries: engineers develop a way to create high-capacity long-life batteries

2019-05-28

Engineers at the University of Tokyo continually pioneer new ways to improve battery technology. Professor Atsuo Yamada and his team

recently developed a material that can significantly extend the life of batteries and afford them higher capacities, as well. From smartphones to pacemakers and cars, batteries power much of our world and their importance only continues to grow. There are two particular aspects of batteries that many believe need to improve to meet our future needs. These are the longevity of the battery and also its capacity—how much charge it can store. The chances are your devices use a type of battery called a lithium-ion battery. But another kind based on sodium rather than lithium may become commonplace soon. Both kinds of battery can store and deliver a large amount of charge, thanks to the way constituent materials pass electrons around. But in both lithium and in sodium batteries, repeated cycles of charging and usage can significantly reduce the storage capacity over time. Inside a typical battery, there are layers of metallic material. As batteries charge and discharge, these layers degrade and develop cracks or flakes—called stacking faults—which reduce the batteries' ability to store and deliver charge. These stacking faults occur because the material is held together by a weak force called the Van der Waals force, which is easily overwhelmed by the stress put on the materials during charging and use. Yamada and colleagues demonstrated that if the battery is made with a model material—oxygen redox-layered oxide (Na2RuO3)—then something remarkable happens. Not only does the degradation from charge and discharge cycles diminish, but the layers actually self-repair. This is because the material the researchers demonstrated is held fast by a force called coulombic attraction, which is far stronger than the Van der Waals force. "This means batteries could have far longer life spans, but also they could be pushed beyond levels that currently damage them," said Yamada. "Increasing the energy density of batteries is of paramount importance to realise electrified transportation."

Phys.org, 16 May 2019

http://phys.org

Researchers have identified and characterised ragweed compounds that could help nerve cells survive in the presence of Alzheimer's disease (AD) peptides.

Ragweed compounds could protect nerve cells from Alzheimer's

2019-05-28

As spring arrives in the northern hemisphere, many people are cursing ragweed, a primary culprit in seasonal allergies. But scientists might have discovered a promising new use for some substances produced by the pesky weed. In ACS' Journal of Natural Products, researchers have identified and characterised ragweed compounds that could help nerve cells survive in the presence of Alzheimer's disease (AD) peptides. Those

with AD, a neurodegenerative disorder, often have impaired judgment, cognition, memory and behaviour. Scientists have linked AD to the accumulation of amyloid-β (Aβ) peptides in the brain, which form plaques that kill nerve cells. Unfortunately, the five drugs currently approved for AD treatment only delay disease progression for a short time. When Won Keun Oh and colleagues screened 300 natural plant extracts for activity against AD in a preliminary study, they found a surprising candidate: Ambrosia artemisiifolia (common ragweed). This invasive weed, native to North America, has now spread to South America, Asia and much of Europe. Oh and colleagues decided to isolate and characterise the structures of ragweed compounds responsible for this neuroprotective activity. The researchers isolated 14 compounds from whole ragweed plants that appeared to protect neurons from Aβ-induced toxicity. They determined the structures of the compounds with nuclear magnetic resonance, mass spectrometry and other analytical techniques. Seven of the chemicals, including terpenoids and spermidine conjugates, had been described previously, but the remainder were newly identified terpenoids. When the researchers added the two most active new compounds to a lab dish that contained neurons producing Aβ, about 20 percent more cells survived than without treatment.

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http://www.eurekalert.org

Lawmakers, Trump agencies set for clash over chemicals in water

2019-05-28

An aggressive push by Congress to pass bipartisan legislation addressing cancer-causing chemicals that are leaching into the water supply is setting the stage for a fight with the Trump administration.

An aggressive push by Congress to pass bipartisan legislation addressing cancer-causing chemicals that are leaching into the water supply is setting the stage for a fight with the Trump administration. The chemicals, commonly abbreviated as PFAS, are used in items ranging from food wrappers and Teflon pans to raincoats and firefighting foam. But studies have found that as they break down and find their way into drinking water, they can cause a variety of negative health effects. PFAS has been linked with kidney and thyroid cancer along with high cholesterol and other illnesses. Contamination has spread to 43 states, and a 2015 study found 98 percent of Americans tested now have the chemical in their blood. But the bipartisan push to tackle the problem is setting up a clash with agencies, in particular the Environmental Protection Agency (EPA) and Pentagon, that have been resistant to regulating the chemicals. Members of Congress have introduced at least 20 bills this session to address PFAS in

some form, a record number and a sign of the growing concern. "It has the most bills because we are now fully aware of the risks and how extensive the contamination is," said Sen. Debbie Stabenow (D-Mich.), whose home state is believed to have the most severe PFAS contamination in the U.S. thanks to Michigan's long manufacturing history and PFAS's use on military sites. PFAS appears in a staggering number of products, and that production, along with heavy use of firefighting foam by the military and at airports, are the main sources for the contamination. Stabenow has sponsored two bills on the topic this year. The broad package of bills in both chambers include measures that would require EPA to set a drinking water standard for PFAS, set deadlines for cleaning up PFAS contamination caused by the federal government, allow the use of Superfund clean-up funds to deal with PFAS contamination, establish a ban on new PFAS chemicals, and provide funding to clean up already-contaminated water. Senators have added some similar measures to this year's defence spending bill. Committee chairpeople in both chambers dealing with PFAS legislation have called the bills a priority. But there remain some tough sticking points, such as whether to address all 4,700 varieties of PFAS or just the handful that have been rigorously studied. Lawmakers, particularly Republicans, are concerned Congress may overstep its authority by jumping ahead of the EPA's own scientific review. And there's also disagreement over how to hold companies and even the government liable for cleaning up contamination. Senate Environment and Public Works Committee Chairman John Barrasso (R-Wyo.) said he's concerned about imposing liability on companies that used products containing PFAS for decades in good faith. "Our nation's airports, refineries, and others used fire-fighting foam containing PFAS in order to protect their workers and the public at large," Barrasso said this week before reviewing several bills. "All these entities were either following regulations or the industry's best practices." The chemicals industry wants the government to tackle each PFAS chemical individually. Kimberly Wise White, senior director of chemical products and technology with the American Chemistry Council, told the Senate Environment and Public Works Committee that some forms of PFAS are not water soluble and should not be blamed for drinking water contamination. "You can't treat all these PFAS chemistries the same. That's why you can't have a one-size-fits-all approach," she said, citing the broad approach of some bills. A bill from Sen. Kirsten Gillibrand (D-N.Y.) would require the EPA to set a drinking water standard for all PFAS, and there's similar legislation in the House. Others would ban new uses or development of PFAS chemicals. Environmentalists argue the chemicals will continue to spread without sweeping action. "If we don't regulate them as a class, we're going to be on this treadmill of trying to regulate

one at a time, and we'll never get off of it," Erik Olson, the health program director at the Natural Resources Defence Council (NRDC), told House members at a hearing earlier this month. Some Republicans worry taking sweeping action would sidestep the EPA and force Congress to weigh the science, and potentially invite lawsuits from companies. "States would face significant unfunded mandates, while foisting obligations on private parties who are currently unaware of potential liability — like farmers using biosolids from wastewater treatment facilities to improve soil health," Rep. Greg Walden (Ore.), the top Republican on the House Energy and Commerce Committee, said at a recent PFAS hearing. "All of this is likely to result in litigation to prevent or prolong the situation, rather than move to promptly address contamination." Democrats have not yet committed to regulating all classes of PFAS, instead asking experts like Olson to weigh in, but there is broad consensus that the EPA response to PFAS has been lacking. "EPA has given us little reason for confidence that they will act with the urgency that impacted communities know is needed," said Rep. Paul Tonko (D-N.Y.), lamenting that it would be years before the agency can set a drinking water standard. "One thing is clear: We cannot wait for EPA to act." EPA will decide by the end of the year whether they want drinking water standards for PFAS, what is known in the agency as a maximum contamination level (MCL). But critics of the agency say they've been dragging their feet on a decision that should have been made shortly after the Obama administration recommended in late 2016 that water should not contain more than 70 parts per trillion (ppt) of PFAS. The EPA declined an interview request for this story and would not comment on any pending legislation. In the absence of action from EPA, eight states have passed their own drinking water standards, many of them lower than the 70 ppt level that EPA recommends. Rep. John Shimkus (R-Ill.), ranking member of the House Energy and Commerce Subcommittee on Environment and Climate Change, said Democrats were rushing to regulate PFAS by legislative fiat rather than giving EPA time to review the chemicals. "We cannot only support the use of science or public input when it guarantees our preferred policy solution," he said in a mid-May hearing on PFAS, saying that role should lie with EPA and not Congress. Shimkus is inclined to support some of the bills, but added, "I have too many questions about the wholesale regulation of this large class of chemicals." The EPA is not the only agency to come under fire for moving slowly on PFAS. The Department of Defence (DOD) is facing a $2 billion clean-up tab, and senators have expressed concern over behind-the-scenes manoeuvring from the Pentagon to get EPA to scale back future PFAS regulations and save the military millions of dollars. Some worry the military won't clean up the chemicals without a push from

Congress. "I think a lot of us learned in kindergarten that if you make a mess, you clean it up," said Olson with the NRDC. "Maybe the Department of Defence didn't learn that lesson in kindergarten and a lot of polluters did not ... It's important to hold those polluters accountable, whether they are federal agencies or private companies." The Pentagon would not comment on pending legislation but denied the military has tried to weaken EPA's approach and said they support EPA setting clean-up standards. "DOD is not seeking a different or weaker clean-up standard but wants the standard risk-based clean-up approach that is based on science and applies to everyone," said Pentagon spokeswoman Heather Babb. Congress secured some funding for clean-up last year, though not enough to tackle the problem. This year's budget would also include funding, though several other bills more specifically outline the military's obligations for cleaning up contaminated water. Stabenow, alongside Sens. Marco Rubio (R-Fla.) and Gary Peters (D-Mich.), sponsored one such bill, dubbed the "PFAS Accountability Act." It would give the military a year to develop a clean-up plan with the state requesting it, and access to grants to help fund the process. If the military misses that deadline, they have to report to Congress. The latest version of this year's defence budget would include a measure similar to Stabenow's and also bar DOD from using firefighting foam that contains PFAS. Finding a consensus on how to push EPA and the Pentagon, though, will be a challenge. "This is very expensive and pretty much connected to every military base," Stabenow said of the contamination. "We want to hold them accountable and move forward to address this."

The Hill, 27 May 2019

https://thehill.com

British specialist among those aiming to develop 'next generation' treatment that could help millions of victims each year

Scientists pursue universal snakebite cure using HIV antibody techniques

2019-05-28

Scientists in five countries, including the UK, hope to find a universal cure for snakebite using the same technology that discovered HIV antibodies. A new consortium of venom specialists in India, Kenya, Nigeria, Britain and the US will locate and develop antibodies to treat critical illness from snakebites, which harm nearly 3 million people worldwide each year. The consortium will seek an antidote comprised of "humanised antibodies" rather than conventional animal-based therapies, which can sometimes cause adverse effects in snakebite victims, said Prof Robert Harrison, who heads the centre for snakebite research and interventions at the

Gossip

Liverpool School of Tropical Medicine. "We're pursuing what we call the 'next generation' of snakebite therapies, which we hope will be able to treat bites from any snake in Africa or India, in a community setting, and without the need for a cold chain," said Harrison. "The conventional method of producing antivenom to treat snakebite involves purifying antibodies from venom-immunised horses or sheep and injecting this into patients. This can cause adverse side effects and, because of that, the antivenom has to be administered in a hospital setting. "That means that victims have to get to hospital from their communities, which are usually several hours away, and in that time, there is usually a progression of very severe pathology, which can sometimes lead to severe disfigurements or death." Rory Stewart, the UK's international development secretary, who last week announced £9m in UK aid to fund the research, said the new antidote would help "develop an affordable, accessible, effective treatment" to envenoming if successful. "In parts of Africa and Asia, snakebites are a daily threat, causing life-changing disabilities or – in the worst case – death," said Stewart. "More than 80,000 people die every year from snakebites and because of the huge variety of snake venoms, people often do not get the treatment they need in time, if at all." The £9m UK pledge is among a flurry of recent commitments directed at transforming snakebite management. Recently, the Wellcome Trust announced an £80m program to improve current therapies and develop new ones. The World Health Organization has announced a new strategy to halve the number of global snakebite deaths by 2030. Collectively, these commitments "provide a complete change in snakebite management and real hope for the future", said Harrison. "For the past 50 or 60 years, there's been no substantial investment whatsoever, so this is a profound game-changer. We struggled for the past 20 years to get enough money to fund research on improving snakebite management, and we're delighted that there's now funding for us and for other important groups like the International Aids Vaccine Initiative. The more science that's thrown at this, the better the global outcome will be." The novel approach towards finding a universal snakebite cure came about after Dr Devin Sok, an American HIV scientist, realised that the methodology of locating the various strains of anti-HIV antibodies could also be applied to snakebite. Sok then contacted Harrison in Liverpool. "Our consortium exemplifies how major global health challenges, like snakebite, can be addressed when leaders in different fields are brought together to share ideas, tools, technologies, and lessons learned," said Sok. "This type of synergy presents a working model for identifying new solutions to long-standing global health challenges and accelerate product development for neglected diseases." Snake venom kills 138,000 people every year and permanently

disables another 400,000. Victims are from the poorest parts of Africa and India, where access to antidotes ranges from non-existent to minimal. Yet antivenom is not the only answer, according to Harrison, who said that in sub-Saharan African, 90% of the available products are ineffective. "They're either made for snakes that are non-African, or the concentrations are too weak to be effective," he said. Ben Waldmann, snakebite program manager for Health Action International, welcomed the WHO's target of halving snakebite deaths by 2030, but said governments must first understand the scale of the problem by accurately recording the number of annual fatalities. Many victims live too far from hospitals to seek professional treatment. "Our research on the ground shows that snakebite victims, faced with no alternative, continue to visit traditional healers as the first point of call," said Waldmann. "If communities are empowered and treatment options improved, it follows that the role of traditional healers will be reduced in favour of an effective and reliable health system." About 250 types of snake have medically harmful venom. The variety and complexity of their poisons pose huge challenge for health workers. Existing anti-venom therapies rely on methods from the 19th century: snakes are milked for their venom, which is then injected into large animals like horses, whose antibodies are harvested for use in humans. But these antivenoms can have harmful – and sometimes lethal – effects on patients, said Harrison, ranging from severe abdominal cramps to anaphylactic shock, because the antibodies are generated from horses or sheep and therefore "foreign". The consortium, called the Scientific Research Partnership for Neglected Tropical Snakebite (SRPNTS), will instead focus on creating "humanised antibodies" developed from blood cells collected from snakebite survivors, as well as from large animals including camels, cows and horses immunised with venoms. The aim is to create "the next generation of snakebite therapies that we will engineer to recognise, bind and nullify all of the toxins of the African and Indian snakes", said Harrison. However, devising a successful antidote will require roughly four years of pre-clinical work, with another three years – "at least" – for manufacturing and clinical trials, he cautioned. The consortium nonetheless believes their combined knowledge may radically alter the way snakebites are dealt with globally.

The Guardian, 24 May 2019

http://www.guardian.com

Gossip

Scientists Have Found a Way to Preserve Vaccines Without Refrigeration For Months

2019-05-28

Vaccines are only as good as the people they treat and absolutely no good if they are spoiled by heat along the way. It's a challenge so great that in some remote parts of the world, this precious medicine has to be transported by camels carrying solar-powered mini refrigerators on their backs. Other populations never get them at all. The need for an uninterrupted, refrigerated trail of vaccines is known as the "cold chain", and in most cases requires consistent storage between 2–8 °C, all the way from production to dispersal; otherwise, it could lay waste to the entire process. "You can spend all kinds of money developing a vaccine, but if it is deactivated by high temperature an hour before you can give it to someone, it doesn't matter," says Ali Ashkar, a pathologist who specialises in immunology at McMaster University in Canada. There are few technical immunisation issues more important, and Ashkar and his colleagues now think they have invented a potential solution, one that could allow vaccines to go unrefrigerated for weeks at a time in warm and remote areas. While other tactics have focused on reengineering the vaccines or modifying their vectors, this new method is based on the simple addition of sugar. In this case, however, the viruses are mixed and then dried into a sugary film, created from a combination of two FDA-approved food preservatives, called pullulan and trehalose. Suspended in this solution, the vaccines can be transported without the need for constant cooling. To reactive them, local clinicians need only add water before administering them to patients, as fresh as if they came from a fridge. "One possible explanation for the synergistic behaviour between these two compounds may be that trehalose provides protection during desiccation while pullulan offers long-term stability by immobilising the viruses in a glassy matrix," the authors explain. So far, the effectiveness has only been tested in mice, so we need to take it with a grain of salt. But using the Herpes Simplex Virus type 2 and the Influenza A virus as examples, using this technique, both vaccines could withstand 40 °C temperatures (104 °F) for at least two months. Even better, the process retains light, durable, compact doses of the vaccine, which are ideal for shipping and transporting. Before this novel solution can be put to the ultimate test, the researchers need to see whether these results translate safely to humans and whether the method works on any other vaccines. If the team can follow through on both these tasks, their relatively cheap process would eliminate almost all the costs of vaccine transport, which today can often account for 80 percent of the entire inoculation process. "This, to us, is the

Vaccines are only as good as the people they treat and absolutely no good if they are spoiled by heat along the way.

ultimate application of this technology," says the paper's lead author and chemical engineer Vincent Leung. "To imagine that something we worked on in the lab could one day be used to save people's lives is very exciting." The authors are particularly excited by the prospects for the distribution of the Ebola vaccine, which currently requires constant frigid temperatures between –70°C or –80°C throughout the entire cold chain. The ability to transport fragile vaccines is a major cause of under-vaccination worldwide, and in some cases, it is making eradication of these deadly viruses impossible. "This problem is especially serious in developing countries and remote areas, which often lack dependable cold chain infrastructure and/or access to reliable electricity," the authors write. "These challenges are compounded with rapid global climate change which have significantly increased the spread of infectious diseases such as malaria, dengue fever, and zika." Rarely do the consequences of these outbreaks remain local. If a disease is allowed to spread unchecked among vulnerable populations, it can all too easily reach other exposed pockets in more populated countries, as measles did in the United States just this year. The inventors have just applied to the Gates Foundation for funding, and according to The National Post, the team hopes they can bring the product to market with a year. This study has been published in Scientific Reports.

Science Alert, 26 May 2019

http://www.sciencealert.com.au

Mesmerising Experiment Shows The Strange Reaction of Vibrating Glass Beads Underwater

2019-05-28

In 1787, the "father of acoustics" Ernst Chladni first recorded the pattern of behaviour of sand grains on a vibrating plate – the way that heavier particles travel away from the vibrations, and lighter particles move towards them. In a new experiment underwater, researchers have now observed the exact opposite happening. This latest study could fundamentally change our thinking about how sound can move particles through vibrations – views that have been in place for over 200 years. Further, it might also open up new methods for manipulating particles in industry and medicine. Scientists from Aalto University in Finland found that when a plate is vibrated underwater, the heavier particles head for the spots where the amplitude of motion is the greatest, known as the antinodes. The term they're using for the strange effect is "inverse Chladni patterns". "This is a surprising result, almost a contradiction to common beliefs," says one of the researchers, Quan Zhou. For the experiment,

Scientists from Aalto University in Finland found that when a plate is vibrated underwater, the heavier particles head for the spots where the amplitude of motion is the greatest, known as the antinodes.

Zhou and his colleagues used glass beads less than a millimetre (0.04 inches) in size, spread over a submerged silicon plate on a piezoelectric transducer. The plate was then vibrated at a variety of frequencies, creating waves on the water. So why was the effect the opposite of what was expected? It was early 19th century scientist Michael Faraday who explained the original effect Chladni saw, suggesting that heavy particles get kicked across the plate until they reach the nodal lines, the points of least vibration. When this happens, they're no longer getting kicked with the same force. The researchers behind the new experiment think that the presence of the waves in the water, the pressure of gravity, and fluid drag act against the natural push for the particles to jump up from the plate's surface. Using this knowledge, the team behind the experiment developed computer algorithms that could adjust the frequency of the plate vibrations in order to control the direction of the glass beads – essentially plotting a course for particles in real time. "We can move particles at almost any frequency, and we do not rely on the resonance of the plate," says Zhou. "This gives us a lot of freedom in motion control." For example, the researchers successfully guided a single particle through a maze, and also merged and separated a swarm of particles by playing different musical notes. If the technique can be successfully scaled down, there are a lot of areas in biological and medical applications where this could come in handy – any kind of situation where tiny objects (maybe even living cells) need to be directed towards a target. "Many procedures in pharmaceutical research and microsystem assembly require the ability to move and manipulate small particles easily," says Zhou. "Using just a single actuator to do all these different things, we are opening a path to new particle handling techniques. Additionally, the method can inspire the future factory-on-a-chip systems." The research has been published in Physical Review Letters.

Science Alert, 25 May 2019

http://www.sciencealert.com.au

A powerful new molecule that extracts salt from liquid has the potential to help increase the amount of drinkable water on Earth, report researchers.

Molecular 'Cage' Can Trap Salt To Clean Drinking Water

2019-05-28

A powerful new molecule that extracts salt from liquid has the potential to help increase the amount of drinkable water on Earth, report researchers. As reported in Science, researchers designed the molecule to capture chloride, which forms when the element chlorine pairs with another element to gain an electron. The most familiar chloride salt is sodium chloride, or common table salt. Other chloride salts are potassium

chloride, calcium chloride, and ammonium chloride. The seepage of salt into freshwater systems reduces access to drinkable water across the globe. In the US alone, about 272 metric tons of dissolved solids, including salts, enter freshwater streams per year, according to US Geological Survey estimates. Contributing factors include the chemical processes involved in oil extraction, the use of road salts and water softeners, and the natural weathering of rock. It only takes one teaspoon of salt to permanently pollute five gallons of water. The new salt-extraction molecule is made up of six triazole "motifs"—five-membered rings composed of nitrogen, carbon, and hydrogen—which together form a three-dimensional "cage" perfectly shaped to trap chloride. In 2008, Flood's lab created a two-dimensional molecule, shaped like a flat doughnut, that used four triazoles. The two extra triazoles give the new molecule its three-dimensional shape and a 10 billion-fold boost in efficacy. The new molecule is also unique because it binds chloride using carbon-hydrogen bonds, previously regarded as too weak to create stable interactions with chloride compared to the traditional use of nitrogen-hydrogen bonds. Despite expectations, the researchers found that the use of triazoles created a cage so rigid as to form a vacuum in the centre, which draws in chloride ions. By contrast, cages with nitrogen-hydrogen bonds are often more flexible, and their vacuum-like centre needed for chloride capture requires energy input, lowering their efficiency compared to a triazole-based cage. "If you were to take our molecule and stack it up against other cages that use stronger bonds, we're talking many orders of magnitude of performance increase," says Amar Flood, professor of chemistry at Indiana University. "This study really shows that rigidity is underappreciated in the design of molecular cages." The rigidity also allows the molecule to retain its shape after the central chloride is lost, compared to other designs that collapse under the same circumstances due to their flexibility. This gives the molecule greater efficacy and versatility. Lastly, the work is reproducible. The first molecule took nearly a year to synthesise, says Yun Liu, who led the study as a PhD student in Flood's lab and is currently a postdoctoral research associate at the University of Illinois at Urbana-Champaign. The crystals they needed to confirm the molecule's unique structure formed after they left the experiment alone in the lab for several months—a surprising occurrence since that process typically requires careful monitoring. Later, Wei Zhao, a postdoctoral researcher in Flood's lab, was able to recreate the molecule in a span of several months. The formation of the crystal represented a "eureka" moment, proving that the molecule's unique design was actually viable, Liu says. Co-author Chun-Hsing "Josh" Chen, an associate scientist at the Molecular Structure Centre at the time of the study, confirmed the molecule's structure using X-ray

crystallography. The US Department of Energy funded the work. Indiana University's Innovation and Commercialization Office has filed a patent application on the work.

Futurity, 24 May 2019

http://www.futurity.org

Building next gen smart materials with the power of sound

2019-05-28

Researchers have used sound waves to precisely manipulate atoms and molecules, accelerating the sustainable production of breakthrough smart materials. Metal-organic frameworks, or MOFs, are incredibly versatile and super porous nanomaterials that can be used to store, separate, release or protect almost anything. Predicted to be the defining material of the 21st century, MOFs are ideal for sensing and trapping substances at minute concentrations, to purify water or air, and can also hold large amounts of energy, for making better batteries and energy storage devices. Scientists have designed more than 88,000 precisely customised MOFs -- with applications ranging from agriculture to pharmaceuticals -- but the traditional process for creating them is environmentally unsustainable and can take several hours or even days. Now researchers from RMIT University in Melbourne, Australia, have demonstrated a clean, green technique that can produce a customised MOF in minutes. Dr Heba Ahmed, lead author of the study published in Nature Communications, said the efficient and scaleable method harnessed the precision power of high-frequency sound waves. "MOFs have boundless potential, but we need cleaner and faster synthesis techniques to take full advantage of all their possible benefits," Ahmed, a postdoctoral researcher in RMIT's Micro/Nanophysics Research Laboratory, said. "Our acoustically-driven approach avoids the environmental harms of traditional methods and produces ready-to-use MOFs quickly and sustainably. "The technique not only eliminates one of the most time-consuming steps in making MOFs, it leaves no trace and can be easily scaled up for efficient mass production." Metal-organic frameworks are crystalline powders full of tiny, molecular-sized holes. They have a unique structure -- metals joined to each other by organic linkers -- and are so porous that if you took a gram of a MOF and spread out its internal surface area, you would cover an area larger than a football pitch. Some have predicted MOFs could be as important to the 21st century as plastics were to the 20th. During the standard production process, solvents and other contaminants become trapped in

Researchers have used sound waves to precisely manipulate atoms and molecules, accelerating the sustainable production of breakthrough smart materials.

the MOF's holes. To flush them out, scientists use a combination of vacuum and high temperatures or harmful chemical solvents in a process called "activation." In their novel technique, RMIT researchers used a microchip to produce high-frequency sound waves. Co-author and acoustic expert Dr Amgad Rezk said these sound waves, which are not audible to humans, can be used for precision micro- and nano-manufacturing. "At the nano-scale, sound waves are powerful tools for the meticulous ordering and manoeuvring of atoms and molecules," Rezk said. The "ingredients" of a MOF -- a metal precursor and a binding organic molecule -- were exposed to the sound waves produced by the microchip. Using the sound waves to arrange and link these elements together, the researchers were able to create a highly ordered and porous network, while simultaneously "activating" the MOF by pushing out the solvents from the holes. Lead investigator, Distinguished Professor Leslie Yeo, said the new method produces MOFs with empty holes and a high surface area, eliminating the need for post-synthesis "activation." "Existing techniques usually take a long time from synthesis to activation but our approach not only produces MOFs within a few minutes, they are already activated and ready for direct application," said Yeo, a Professor of Chemical Engineering and Director of the Micro/Nanophysics Research Laboratory at RMIT. The researchers successfully tested the approach on copper and iron-based MOFs, with the technique able to be expanded to other MOFs and scaled out for efficient green production of these smart materials. "Acoustomicrofluidic assembly of oriented and simultaneously-activated metal-organic frameworks," with collaborators from CSIRO and the ARC Centre of Excellence in Convergent Bio-Nano Science and Technology at University of Melbourne, is published in Nature Communications.

Science Daily, 23 May 2019

http://www.sciencedaily.com

One of the big issues with sustainable energy systems is how to store electricity that's generated from wind, solar and waves. Engineered electroactive microbes could be part of the solution.

Engineered bacteria could be missing link in energy storage

2019-05-28

One of the big issues with sustainable energy systems is how to store electricity that's generated from wind, solar and waves. At present, no existing technology provides large-scale storage and energy retrieval for sustainable energy at a low financial and environmental cost. Engineered electroactive microbes could be part of the solution; these microbes are capable of borrowing an electron from solar or wind electricity and using the energy to break apart carbon dioxide molecules from the air.

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The microbes can then take the carbon atoms to make biofuels, such as isobutanol or propanol, that could be burned in a generator or added to gasoline, for example. "We think biology plays a significant role in creating a sustainable energy infrastructure," said Buz Barstow, assistant professor of biological and environmental engineering at Cornell University. "Some roles will be supporting roles and some will be major roles, and we're trying to find all of those places where biology can work." Barstow is the senior author of "Electrical Energy Storage With Engineered Biological Systems," published in the Journal of Biological Engineering. Adding electrically engineered (synthetic or non-biological) elements could make this approach even more productive and efficient than microbes alone. At the same time, having many options also creates too many engineering choices. The study supplies information to determine the best design based on needs. "We are suggesting a new approach where we stitch together biological and non-biological electrochemical engineering to create a new method to store energy," said Farshid Salimijazi, a graduate student in Barstow's lab and the paper's first author. Natural photosynthesis already offers an example for storing solar energy at a huge scale, and turning it into biofuels in a closed carbon loop. It captures about six times as much solar energy in a year as all civilization uses over the same time. But, photosynthesis is really inefficient at harvesting sunlight, absorbing less than one percent of the energy that hits photosynthesizing cells. Electroactive microbes let us replace biological light harvesting with photovoltaics. These microbes can absorb electricity into their metabolism and use this energy to convert CO2 to biofuels. The approach shows a lot of promise for making biofuels at higher efficiencies. Electroactive microbes also allow for the use of other types of renewable electricity, not just solar electricity, to power these conversions. Also, some species of engineered microbes may create bioplastics that could be buried, thereby removing carbon dioxide (a greenhouse gas) from the air and sequestering it in the ground. Bacteria could be engineered to reverse the process, by converting a bioplastic or biofuel back to electricity. These interactions can all occur at room temperature and pressure, which is important for efficiency. The authors point out that non-biological methods for using electricity for carbon fixation (assimilating carbon from CO2 into organic compounds, such as biofuels) are starting to match and even exceed microbes' abilities. However, electrochemical technologies are not good at creating the kinds of complex molecules necessary for biofuels and polymers. Engineered electroactive microbes could be designed to convert these simple molecules into much more complicated ones. Combinations of engineered microbes and electrochemical systems could greatly exceed the efficiency of photosynthesis. For these reasons,

a design that marries the two systems offers the most promising solution for energy storage, according to the authors. "From the calculations that we have done, we think it's definitely possible," Salimijazi said. The paper includes performance data on biological and electrochemical designs for carbon fixation. The current study is "the first time that anybody has gathered in one place all of the data that you need to make an apples-to-apples comparison of the efficiency of all these different modes of carbon fixation," Barstow said. In the future, the researchers plan to use the data they have assembled to test out all possible combinations of electrochemical and biological components, and find the best combinations out of so many choices. The study was supported by Cornell and the Burroughs-Wellcome Fund.

Science Daily, 23 May 2019

http://www.sciencedaily.com

Major step forward in the production of 'green' hydrogen

2019-05-28

The first thermodynamically-reversible chemical reactor capable of producing hydrogen as a pure product stream represents a "transformational" step forward in the chemical industry, the authors of a new study claim. The novel reactor, described today in the prestigious academic journal Nature Chemistry, avoids mixing reactant gases by transferring oxygen between reactant streams via a solid-state oxygen reservoir. This reservoir is designed to remain close to equilibrium with the reacting gas streams as they follow their reaction trajectory and thus retains a 'chemical memory' of the conditions to which it has been exposed. The result is that hydrogen is produced as a pure product stream, removing the need for costly separation of the final products. Led by Newcastle University, UK, the research involved experts from the universities of Durham and Edinburgh and the European Synchrotron Radiation Facility in France, and was funded by the Engineering and Physical Sciences Research Council (EPSRC). Professor Ian Metcalfe, lead author and Professor of Chemical Engineering at Newcastle University said: "Chemical changes are usually performed via mixed reactions whereby multiple reactants are mixed together and heated. But this leads to losses, incomplete conversion of reactants and a final mixture of products that need to be separated. "With our Hydrogen Memory Reactor we can produce pure, separated products. You could call it the perfect reactor."

The first thermodynamically-reversible chemical reactor capable of producing hydrogen as a pure product stream represents a "transformational" step forward in the chemical industry, the authors of a new study claim.

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Most abundant element in the universe

Hydrogen is the most abundant element in the universe. Produced through the splitting of water molecules, the shift towards renewable energy has led to a rise in so-called 'green hydrogen'. Hydrogen is a clean and useful energy store and can be used as a fuel, to generate electricity and can be stored and transported via the gas networks. All processes—be they chemical, mechanical or electrical—are thermodynamically irreversible, and are less efficient that they otherwise could be. This means that in traditional chemical reactors when hydrogen is produced it needs to be separated from other products, a process which is both costly and often energy intensive. Describing their new system, the team demonstrate a chemical reactor capable for the first time of approaching thermodynamically-reversible operation. Reacting water and carbon monoxide to generate hydrogen and carbon dioxide, the system also prevents carbon being carried into the hydrogen produce stream as carbon monoxide or carbon dioxide, thus avoiding contamination of the product. 'Flipping' the reservoir a bit like a switch, the team showed it is possible to reach high conversion in the system so that carbon dioxide and hydrogen are produced at either end of the reactor as pure products. "Whereas conventional hydrogen production requires two reactors and a separation, our reactor accomplishes all the steps in one unit," adds Professor Metcalfe. "And while we demonstrate the concept with hydrogen, the memory reactor concept may also be applied to other processes."

Phys.org, 27 May 2019

http://phys.org

Aluminium is one of the most promising materials for aeronautics and automobile industry.

Scientists create new aluminium alloy with flexibility, strength, lightness

2019-05-28

Aluminium is one of the most promising materials for aeronautics and automobile industry. Scientists from the National University of Science and Technology (MISIS) found a simple and efficient way of strengthening aluminium-based composite materials. Doping aluminium melt with nickel and lanthanum, scientists managed to create a material combining benefits of both composite materials and standard alloys: flexibility, strength, lightness. The article on the research is published in Materials Letters. Lighter and faster aircraft and vehicles require lighter materials. One of the most promising materials is aluminium, or rather, aluminium-

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based composites. Scientists from NUST MISIS scientific school "Phase Transitions and Development of Non-Ferrous Alloys" created a new strong Al-Ni-La composite for aircraft and automobile industry. Doping elements were added to the aluminium melt, forming special chemical compounds that further formed strong reinforcing structure. "Our research group, led by Professor Nikolai Belov, has worked on the creation of aluminium-based composites for many years. Al-Ni-La composite is one of such projects, aimed at creation of "natural" aluminium-based composite material with more than 15% vol. of doping elements. A feature of the new development is the high reinforcing ability of the chemical compounds with ultrafine structure: the diameter of the reinforcing elements does not exceed several tens of nanometres. Previously, researchers were limited to the study of systems in which it is obviously impossible to obtain an effective reinforcing structure. Or they manufactured composite materials by labour-intensive powder metallurgy methods (sintering of powders), or liquid-phase technologies of kneading nanoparticles in the melt," Torgom Akopyan, one of the authors, researcher at NUST MISIS Department of Metal Forming, comments. Today, aluminium is reinforced mainly with the help of nanopowders, but this is an extremely expensive and time-consuming process, where the result does not always justify the cost. For example, with an increase in strength by only 5-20%, plasticity can decrease by tens of percent or even several times. In addition, the particles themselves are too large—from 100 nanometres to 1-2 micrometres, and their % vol. is low. Development of NUST MISIS scientist solves the problem of non-uniform reinforcement and low density of "powder" composites: if a melting technique is used, after Al-Ni-La crystallisation the diameter of doping particle does not exceed 30-70 nanometres. Thanks to "natural" crystallisation, particles are distributed uniformly, forming a reinforcing structure. Hence, the composite becomes stronger and more flexible than its powder analogues. "Our composite already demonstrates better characteristics than its analogues, including foreign ones. However, we are not going to stop here, and in the future we plan to continue working on the creation of more advanced, complex (3-, 4- and more-phase) and cheap composites, the production cycle of which will include the use of aluminium of technical purity and cheaper alloying components," Torgom adds. According to scientists, the proposed material can be used primarily in aeronautics and automobile industry, as well as for the design of modern robotics, including copters, where reducing the weight of the drone is critical. Due to the peculiarities of the structure formation, the proposed material can be used for the manufacture of complex parts via 3-D printing. In addition, new developments may be of strategic importance from an economic point of view. At the moment,

the main share of profit in the aluminium industry in Russia is the export of primary aluminium. The creation of new high-tech developments with increased added value will increase profits by expanding domestic and foreign markets for aluminium consumption.

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http://phys.org

Engineers create a simple test that can measure stress hormones in sweat, blood, urine or saliva

2019-05-28

Stress is often called "the silent killer" because of its stealthy and mysterious effects on everything from heart disease to mental health. Now researchers at the University of Cincinnati have developed a new test that can easily and simply measure common stress hormones using sweat, blood, urine or saliva. Eventually, they hope to turn their ideas into a simple device that patients can use at home to monitor their health. The results were published this month in the journal American Chemical Society Sensors. "I wanted something that's simple and easy to interpret," said Andrew Steckl, an Ohio Eminent Scholar and professor of electrical engineering in UC's College of Engineering and Applied Science. "This may not give you all the information, but it tells you whether you need a professional who can take over," Steckl said. UC researchers developed a device that uses ultraviolet light to measure stress hormones in a drop of blood, sweat, urine or saliva. These stress biomarkers are found in all of these fluids, albeit in different quantities, Steckl said. "It measures not just one biomarker but multiple biomarkers. And it can be applied to different bodily fluids. That's what's unique," he said. University of Cincinnati research assistant Shima Dalirirad, left, talks to UC professor Andrew Steckl in his Nanoelectronics Laboratory. Credit: Andrew Higley/UC Creative Services

Researchers at the University of Cincinnati have developed a new test that can easily and simply measure common stress hormones using sweat, blood, urine or saliva.

Steckl has been studying biosensors for years in his Nanoelectronics Laboratory. The latest journal article is part of a series of research papers his group has written on biosensors, including one that provides a review of methods for point-of-care diagnostics of stress biomarkers. Personal experience helping his father with a health crisis informed his research and opinion that a home test for various health concerns would be incredibly helpful. "I had to take him quite often to the lab or doctor to have tests done to adjust his medication. I thought it would be great if he could just do the tests himself to see if he was in trouble or just imagining things,"

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Steckl said. "This doesn't replace laboratory tests, but it could tell patients more or less where they are." UC received grant funding for the project from the National Science Foundation and the U.S. Air Force Research Lab. Steckl said the military studies acute stress in its pilots and others who are pushing the edges of human performance. "Pilots are placed under enormous stress during missions. The ground controller would like to know when the pilot is reaching the end of his or her ability to control the mission properly and pull them out before a catastrophic ending," Steckl said. But the UC device has widespread applications, Steckl said. His lab is pursuing the commercial possibilities. "You're not going to replace a full-panel laboratory blood test. That's not the intent," Steckl said. "But if you're able to do the test at home because you're not feeling well and want to know where you stand, this will tell whether your condition has changed a little or a lot." UC graduate Prajokta Ray, the study's first author, said she was excited to work on such a pressing problem for her Ph.D. studies. "Stress harms us in so many ways. And it sneaks up on you. You don't know how devastating a short or long duration of stress can be," Ray said. "So many physical ailments such as diabetes, high blood pressure and neurological or psychological disorders are attributed to stress the patient has gone through. That's what interested me." Ray said taking exams always gave her stress. Understanding how stress affects you individually could be extremely valuable, she said. "Stress has been a hot topic over the past couple years. Researchers have tried very hard to develop a test that is cheap and easy and effective and detect these hormones in low concentrations," she said. "This test has the potential to make a strong commercial device. It would be great to see the research go in that direction." UC is at the forefront of biosensor technology. Its labs are examining continuous sweat testing and point-of-care diagnostics for everything from traumatic brain injury to lead poisoning. Steckl, too, has been a preeminent innovator at UC. His papers have been cited more than 13,000 times, according to Google Scholar. In 2016, he used salmon sperm, a common by-product of the fishing industry, to replace rare earth metals used in light-emitting diodes for a new kind of organic LED. "We're device engineers at heart," Steckl said. "We don't shy away from things we don't know much about to begin with. We look for opportunities. That's a hallmark of electrical engineers. We're not smart enough not to go where we shouldn't. Sometimes that pays off!"

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Adding a carbon atom transforms 2D semiconducting material

2019-05-28

A technique that introduces carbon-hydrogen molecules into a single atomic layer of the semiconducting material tungsten disulfide dramatically changes the electronic properties of the material, according to Penn State researchers at Penn State who say they can create new types of components for energy-efficient photoelectric devices and electronic circuits with this material. "We have successfully introduced the carbon species into the monolayer of the semiconducting material," said Fu Zhang, doctoral student in materials science and engineering lead author of a paper published online 26 May in Science Advances. Prior to doping - adding carbon - the semiconductor, a transition metal dichalcogenide (TMD), was n-type -- electron conducting. After substituting carbon atoms for sulfur atoms, the one-atom-thick material developed a bipolar effect, a p-type -- hole -- branch, and an n-type branch. This resulted in an ambipolar semiconductor. "The fact that you can change the properties dramatically by adding as little as two atomic percent was something unexpected," Mauricio Terrones, senior author and distinguished professor of physics, chemistry and materials science and engineering. According to Zhang, once the material is highly doped with carbon, the researchers can produce a degenerate p-type with a very high carrier mobility. "We can build n+/p/n+ and p+/n/p+ junctions with properties that have not been seen with this type of semiconductor," he said. In terms of applications, semiconductors are used in various devices in industry. In this case, most of those devices will be transistors of different sorts. There are around 100 trillion transistors in a laptop. "This type of material might also be good for electrochemical catalysis," Terrones said. "You could improve conductivity of the semiconductor and have catalytic activity at the same time." There are few papers in the field of 2D materials doping, because it requires multiple processes to take place simultaneously under specific types of conditions. The team's technique uses a plasma to lower the temperature at which methane can be cracked - split apart - down to 752 degrees Fahrenheit. At the same time, the plasma has to be strong enough to knock a sulfur atom out of the atomic layer and substitute a carbon-hydrogen unit. "It's not easy to dope monolayers, and then to measure carrier transport is not trivial," Terrones says. "There is a sweet spot where we are working. Many other things are required." Susan Sinnott, professor and head of the Department of Materials Science and Engineering, provided theoretical calculations that guided the experimental work. When Terrones and Zhang observed that doping the

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2D material was changing its optical and electronic properties - something they had never seen before - Sinnott's team predicted the best atom to dope with and predicted the properties, which corresponded with the experiment. Saptarshi Das, assistant professor of engineering science and mechanics, and his group, then measured the carrier transport in various transistors with increasing amounts of carbon substitution. They watched the conductance change radically until they had completely changed the conduction type from negative to positive. "It was very much a multidisciplinary work," Terrones says.

EurekAlert, 24 May 2019

http://www.eurekalert.org

Carnegie Mellon researchers create soft, flexible materials with enhanced properties

2019-05-29

A team of polymer chemists and engineers from Carnegie Mellon University have developed a new methodology that can be used to create a class of stretchable polymer composites with enhanced electrical and thermal properties. These materials are promising candidates for use in soft robotics, self-healing electronics and medical devices. The results are published in the May 20 issue of Nature Nanotechnology.
In the study, the researchers combined their expertise in foundational science and engineering to devise a method that uniformly incorporates eutectic gallium indium (EGaIn), a metal alloy that is liquid at ambient temperatures, into an elastomer. This created a new material -- a highly stretchable, soft, multi-functional composite that has a high level of thermal stability and electrical conductivity. Carmel Majidi, a professor of Mechanical Engineering at Carnegie Mellon and director of the Soft Machines Lab, has conducted extensive research into developing new, soft materials that can be used for biomedical and other applications.
As part of this research, he developed rubber composites seeded with nanoscopic droplets of liquid metal. The materials seemed to be promising, but the mechanical mixing technique he used to combine the components yielded materials with inconsistent compositions, and as a result, inconsistent properties. To surmount this problem, Majidi turned to Carnegie Mellon polymer chemist and J.C. Warner University Professor of Natural Sciences Krzysztof Matyjaszewski, who developed atom transfer radical polymerization (ATRP) in 1994. ATRP, the first and most robust method of controlled polymerization, allows scientists to string together monomers in a piece-by-piece fashion, resulting in highly-tailored

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polymers with specific properties. "New materials are only effective if they are reliable. You need to know that your material will work the same way every time before you can make it into a commercial product," said Matyjaszewski. "ATRP has proven to be a powerful tool for creating new materials that have consistent, reliable structures and unique properties." Majidi, Matyjaszewski and Materials Science and Engineering Professor Michael R. Bockstaller used ATRP to attach monomer brushes to the surface of EGaIn nanodroplets. The brushes were able to link together, forming strong bonds to the droplets. As a result, the liquid metal uniformly dispersed throughout the elastomer, resulting in a material with high elasticity and high thermal conductivity. Matyjaszewski also noted that after polymer grafting, the crystallization temperature of eGaIn was suppressed from 15 C to -80 C, extending the droplet's liquid phase ¬-- and thus its liquid properties -- down to very low temperatures. "We can now suspend liquid metal in virtually any polymer or copolymer in order to tailor their material properties and enhance their performance," said Majidi. "This has not been done before. It opens the door to future materials discovery." The researchers envision that this process could be used to combine different polymers with liquid metal, and by controlling the concentration of liquid metal, they can control the properties of the materials they are creating. The number of possible combinations is vast, but the researchers believe that with the help of artificial intelligence, their approach could be used to design "made-to-order" elastomer composites that have tailored properties. The result will be a new class of materials that can be used in a variety of applications, including soft robotics, artificial skin and bio-compatible medical devices.

EurekAlert, 23 May 2019

http://www.eurekalert.org

Researchers have created plumbene by annealing an ultrathin lead (Pb) film on palladium Pd(111).

Plumbene, graphene's latest cousin, realized on the 'nano water cube'

2019-05-29

Two-dimensional materials made of Group 14 elements, graphene's cousins, have attracted enormous interest in recent years because of their unique potential as useful topological insulators. In particular, the up-to-now purely theoretical possibility of a lead-based 2D honeycomb material, called plumbene, has generated much attention because it has the largest spin-orbit interaction, due to lead's orbital electron structure and therefore the largest energy band gap, potentially making it a robust 2D topological insulator in which the Quantum Spin Hall Effect might

occur even above room temperature. For this reason, finding a reliable and cheap method of synthesising plumbene has been considered to be an important goal of materials science research. Now, Nagoya University-led researchers have created plumbene by annealing an ultrathin lead (Pb) film on palladium Pd(111). The resulting surface material has the signature honeycomb structure of a 2D monolayer, as revealed by scanning tunnelling microscopy. Surprisingly, beneath the plumbene, a palladium-lead (Pd-Pb) alloy thin film forms with a bubble structure reminiscent of a Weaire-Phelan structure (which partitions space into cells of equal volume with the least total surface area of the walls between them, solving the "Kelvin Problem"). The Weaire-Phelan structure was the inspiration for the design of the Beijing National Aquatics Centre ("Water Cube") of the 2008 Olympics in Beijing. Group leader Professor Junji Yuhara jokingly recalls that the case of the Beijing Water Cube and the Weaire-Phelan structure is not the first time that architects and materials scientists have inspired each other. "Architect Buckminster Fuller designed the geodesic sphere for the World Expo 1967 in Montreal, and later the Buckminster Fullerene, C60, was named after him." According to Professor Yuhara, "Both plumbene and the 'nano water cube' are a beautiful addition to the Nano Nature World. The buildings of the 2020 Tokyo Olympics, the 2024 Paris Olympics, Expo 2020 Dubai, Expo 2023 Buenos Aires, Expo 2025 Osaka, and so on may also be placed in the spotlight again as future new materials," he says. "The advent of plumbene", remarks Professor Yuhara, "has been long awaited, and comes after the creation of silicene in 2012, germanene in 2014 and stanene in 2015. It will certainly launch a rush for applications."

EurekAlert, 26 May 2019

http://www.eurekalert.org

Chemical juggling with three particles

2019-05-29

Chemists from the University of Bonn and their U.S. colleagues at Columbia University in New York have discovered a novel mechanism in catalysis that allows the cheap, environmentally friendly synthesis of certain alcohols. The reaction follows a previously unknown pattern in which hydrogen is split into three components in a time-coordinated manner. More than five years passed between the idea and its practical realization. The results are published in Science. Alcohols are common chemical compounds which, in addition to carbon and hydrogen, contain at least one OH group. They serve as starting materials for a whole series of chemical syntheses and are often produced directly from olefins

Chemists from the University of Bonn and their U.S.

by addition of water. Olefins are hydrocarbons with a double bond available from oil. The water molecule serves as a "donor" of the OH-group characteristic of alcohols. This synthesis is simple and efficient, but it has a decisive disadvantage: It can only be used to produce certain alcohols, the so-called Markovnikov alcohols. The OH group cannot simply be attached to any position of the olefin—one of two positions are excluded. "We have now found a new catalytic method that can produce exactly these 'impossible' alcohols," says Prof. Dr. Andreas Gansäuer. Gansäuer works at the Kekulé Institute of Organic Chemistry and Biochemistry at the University of Bonn. The idea for the new synthesis emerged in a 2013 collaboration with the group of Prof. Dr. Jack Norton of Columbia University in New York. However, it took almost five years until the synthesis of the so-called anti-Markovnikov alcohol using the new catalytic system worked well enough to be published.

Acceleration and slowing down by the catalysts' ligands

The process has an unusual reaction mechanism. Epoxides, common and valuable intermediate products of the chemical industry, serve as starting materials. Epoxides can be produced by adding an oxygen atom (chemical symbol: O) to olefins. If they are allowed to react with hydrogen molecules (H_2), the oxygen becomes an OH group. Normally, with this approach only Markovnikov alcohols are produced. "In our reaction, however, we successively transfer the hydrogen in three parts," explains Gansäuer. "First, a negatively charged electron, then a neutral hydrogen atom and finally a positively charged hydrogen ion, a proton. We use two catalysts, one of which contains titanium and the other chromium. This allows us to convert epoxides into anti-Markovnikov alcohols." The timing of the entire process must be strictly coordinated—as in juggling, in which each ball has to maintain a specified flight duration. To achieve this, the chemists had to synchronise the speed of three catalytic reactions. To this end, they attached the "right" ligands, molecules that control the metals' reactivity, to the titanium and chromium atoms. Until now, anti-Markovnikov alcohols have been produced through a so-called hydroboration followed by an oxidation. However, this reaction is relatively complex and not particularly sustainable. The new mechanism, on the other hand, does not produce any by-products and is thus practically waste-free. "Titanium and chromium are also very common metals, unlike many other noble metals that are often used in catalysis," Gansäuer emphasises. In 2013, Norton and Gansäuer submitted their idea to a call for proposals on sustainable catalysis by the International Union of Pure and Applied Chemistry (IUPAC), winning first place. The project was largely financed with the

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grant money. "But the good cooperation within my institute has certainly also contributed to the success," emphasises Gansäuer. "For instance, I had access not only to the institute's resources, but also to equipment of the other groups from Bonn."

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http://phys.org

Curiosities

Too much vitamin B6 and B12 tied to hip fractures in older women

2019-05-29

Older women who take supplements with high doses of vitamins B6 and B12 may be more likely than their counterparts who don't to experience hip fractures, a U.S. study suggests. While some previous research has linked both of these vitamins to a lower risk of heart disease, results have been mixed and some studies have also tied B6 and B12 to fractures in older adults, researchers note in JAMA Network Open. Under current U.S. dietary guidelines, women over age 50 should get 1.5 milligrams (mg) a day of B6, and girls and women aged 14 and up should get 2.4 daily micrograms (mcg, which is 1 one-thousandth of a milligram) of B12. For the current study, researchers followed almost 76,000 female nurses in the U.S. for an average of 21 years, doing extensive dietary surveys roughly every four years. Almost all of the women in the study had total intake of B6 and B12 from foods and supplements that was higher than recommended. About 2,300 women had hip fractures during the study, and half of them had these fractures before they were 76 years old. Compared to women who had the lowest intake of both vitamins, women who had the highest daily intake - at least 35 mg of B6 and 20 mcg of B12 - were 47 percent more likely to have hip fractures during the study. "Many people take supplements without clear indications, and high dose vitamin supplements are readily available in drug stores and on the internet," said lead study author Dr. Haakon Meyer of the University of Oslo in Norway. "Our results add to other reports suggesting that high-dose vitamin supplementation can lead to unexpected adverse effects," Meyer said by email. "Normal intakes of these vitamins, corresponding to recommended dietary allowances, were not associated with increased fracture risk." Vitamin B6 helps the body maintain a healthy metabolism and immune system and is found in a variety of foods, including meat, fish, chickpeas, potatoes and other starchy vegetables. B12 helps the body make red blood cells and is naturally found in clams, fish, meat, eggs and dairy products. Half of the women in the study had daily vitamin intake of at least 3.6 mg of B6 and 12.1 mcg of B12. The study wasn't designed to prove whether or how high intake of B6 or B12 might contribute to risk for hip fractures. It's also possible that the study population of predominately white, insured and middle-class women might not reflect what would happen with all older women in the U.S. Even so, the results underscore the importance of getting a check-up before starting any vitamin supplements, said Dr. Karen Hansen, a researcher at the University of Wisconsin School of Medicine & Public Health in Madison. "Women should

Older women who take supplements with high doses of vitamins B6 and B12 may be more likely than their counterparts who don't to experience hip fractures, a U.S.

seek their primary care provider's advice on whether to take a vitamin B supplement," Hansen, who wasn't involved in the study, said by email. "If the provider documents a vitamin deficiency, then a supplement is clearly warranted," Hansen said. "However, in the absence of a documented deficiency, (several) studies collectively suggest that vitamin B6 and vitamin B12 will not improve skeletal health, and might even be harmful."

Reuters Health, 16 May 2019

Why cheese may help control your blood sugar

2019-05-29

Mmmm, cheese – a food as nutritious as it is delicious. Or is it? On the one hand, cheese is an excellent source of minerals like calcium and magnesium, vitamins A, B2 and B12, not to mention being a complete protein. On the other hand, cheese is also a significant source of saturated fat and sodium in our diets. To lower saturated fat intake, consuming reduced-fat cheese is sometimes recommended to lower cardiovascular disease risk. Paradoxically, however, there is now a growing body of evidence that people who eat lots of cheese do not have a higher risk of cardiovascular diseases, including Type 2 diabetes. Our research team at the University of Alberta examined the impact of both reduced- and regular-fat cheese on insulin resistance in the bodies of pre-diabetic rats. We found that both types of cheese reduced insulin resistance, which is important to maintain normal blood sugars.

A study from the University of Alberta suggests that the beneficial effects of cheese might not be related to fat but to some other component, such as protein or calcium.

Why we used rats

Many of the studies previously conducted into the impact of cheese on cardiovascular disease (CVD) have been observational. In other words, researchers have studied the usual eating behaviour of large numbers of people, usually for years, and then correlated the amount of cheese (and other dairy foods) eaten with the development of CVD risks, such as high cholesterol or coronary artery disease. A 2016 survey of published observational studies found that cheese had either a neutral or beneficial effect on several CVD risk factors These studies are very useful to establish trends associated with usual eating patterns but they can't definitively say that a particular food causes or prevents a particular disease. To understand causation better, studies that examine the effects of foods in a controlled setting are useful. These studies can be conducted in humans but there are limitations. Thus, studies in laboratory animals can also be useful, particularly in understanding biochemical mechanisms.

Cheese and insulin resistance

Curiosities

Insulin resistance is a condition that commonly develops with ageing and obesity, leading to high blood glucose, and risk factor of CVD and Type 2 diabetes. Our objective was to compare how consuming reduced- versus regular-fat cheese affected insulin resistance, and to explore biochemical mechanisms that might explain any observed effects. We used a rat model of insulin resistance that shares many characteristics with humans. We created the model by feeding the rats high amounts of lard. After four weeks, the rats were divided into three groups: 1) lard diet, 2) lard diet and reduced-fat cheddar cheese, 3) lard diet and regular fat cheddar cheese. All the diets had the same total amount of fat, only the source of it varied (lard versus cheese). The rats ate these diets for eight more weeks. The most interesting finding in our research was that both reduced- and regular-fat cheddar cheese reduced insulin resistance in the rats. This suggests that the beneficial effects of cheese might not be related to the amount of fat but to some other component, such as the protein or the calcium.

Butter versus cheese

A few new studies in humans have appeared in the literature since we began our study. A group from Laval University and the University of Manitoba compared the effects of eating fats from different sources in men and women with abdominal obesity. The diet duration was four weeks and each diet was assessed in all the participants. Butter, cheese, olive oil and corn oil diets (32 per cent calories from fat) were compared with a higher carbohydrate diet (25 per cent calories from fat). The researchers examined blood glucose and insulin levels (which are indirect indicators of insulin resistance) and found no effect from any of the fats. However, the blood samples were collected after fasting, so the information about blood sugar was incomplete. Another study that compared reduced- to regular-fat cheese found no overall differences on LDL-cholesterol characteristics in people with cardiovascular disease risk factors, but did not examine blood sugar-related outcomes.

Changing blood metabolites

In our study, we also examined how metabolites in the blood changed after cheese feeding and found similar effects in reduced- and regular-fat cheese. The changes are related to a specific type of molecule called phospholipids, which have many functions in the body. Interestingly, low-circulating phospholipids are linked with diabetes and insulin resistance in humans. The rats fed on a lard diet had lower phospholipid levels. These were normalised in the rats that ate cheese. We are pursuing this line

of research now — to understand how cheese regulates phospholipid metabolism and how this relates to insulin resistance.

The Conversation, 8 May 2019

http://www.theconversation.com

Anxiety might be alleviated by regulating gut bacteria

2019-05-29

People who experience anxiety symptoms might be helped by taking steps to regulate the microorganisms in their gut using probiotic and non-probiotic food and supplements, suggests a review of studies published today in the journal General Psychiatry. Anxiety symptoms are common in people with mental diseases and a variety of physical disorders, especially in disorders that are related to stress. Previous studies have shown that as many as a third of people will be affected by anxiety symptoms during their lifetime. Increasingly, research has indicated that gut microbiota—the trillions of microorganisms in the gut which perform important functions in the immune system and metabolism by providing essential inflammatory mediators, nutrients and vitamins—can help regulate brain function through something called the "gut-brain axis." Recent research also suggests that mental disorders could be treated by regulating the intestinal microbiota, but there is no specific evidence to support this. Therefore, a team of researchers from the Shanghai Mental Health Centre at Shanghai Jiao Tong University School of Medicine, set out to investigate if there was evidence to support improvement of anxiety symptoms by regulating intestinal microbiota. They reviewed 21 studies that had looked at 1,503 people collectively. Of the 21 studies, 14 had chosen probiotics as interventions to regulate intestinal microbiota (IRIFs), and seven chose non-probiotic ways, such as adjusting daily diets. Probiotics are living organisms found naturally in some foods that are also known as "good" or "friendly" bacteria because they fight against harmful bacteria and prevent them from settling in the gut. The researchers found that probiotic supplements in seven studies within their analysis contained only one kind of probiotic, two studies used a product that contained two kinds of probiotics, and the supplements used in the other five studies included at least three kinds. Overall, 11 of the 21 studies showed a positive effect on anxiety symptoms by regulating intestinal microbiota, meaning that more than half (52%) of the studies showed this approach to be effective, although some studies that had used this approach did not find it worked. Of the 14 studies that had used probiotics as the intervention, more than a third (36%) found them to be effective in reducing anxiety symptoms,

People who experience anxiety symptoms might be helped by taking steps to regulate the microorganisms in their gut using probiotic and non-probiotic food and supplements, suggests a review of studies published today in the journal General Psychiatry.

while six of the remaining seven studies that had used non-probiotics as interventions found those to be effective—a 86% rate of effectiveness. Some studies had used both the IRIF (interventions to regulate intestinal microbiota) approach and treatment as usual. In the five studies that used treatment as usual and IRIF as interventions, only studies that had conducted non-probiotic ways got positive results, that showed a reduction in anxiety symptoms. Non-probiotic interventions were also more effective in the studies that used IRIF alone. In those studies, only using IRIF, 80% were effective when using non-probiotic interventions, while only 45% were found to be effective when using probiotic ways. The authors say one reason that non-probiotic interventions were significantly more effective than probiotic interventions were possible due to the fact that changing diet (a diverse energy source) could have more of an impact on gut bacteria growth than introducing specific types of bacteria in a probiotic supplement. Also, because some studies had involved introducing different types of probiotics, these could have fought against each other to work effectively, and many of the intervention times used might have been too short to significantly increase the abundance of the imported bacteria. Most of the studies did not report serious adverse events, and only four studies reported mild adverse effects such as dry mouth and diarrhoea. This is an observational study, and as such, cannot establish cause. Indeed, the authors acknowledge some limitations, such as differences in study design, subjects, interventions and measurements, making the data unsuitable for further analysis. Nevertheless, they say the overall quality of the 21 studies included was high. The researchers conclude: "We find that more than half of the studies included showed it was positive to treat anxiety symptoms by regulation of intestinal microbiota. "There are two kinds of interventions (probiotic and non-probiotic interventions) to regulate intestinal microbiota, and it should be highlighted that the non-probiotic interventions were more effective than the probiotic interventions. More studies are needed to clarify this conclusion since we still cannot run meta-analysis so far." They also suggest that, in addition to the use of psychiatric drugs for treatment, "we can also consider regulating intestinal flora to alleviate anxiety symptoms."

Medical Xpress, 20 May 2019

http://medicalxpress.com

Curiosities

Our Love of Starch Changed Our Genes (And Our Spit)

2019-05-29

A new study clarifies how the pursuit of starch may have driven evolutionary adaptations in mammals. Starch, a complex carbohydrate, is a vital source of nutrition for many mammals. Humans farm it in the form of rice, wheat, corn, potatoes, and oats. Rats comb our garbage piles for scraps of pizza and bread. Wild boars root for tubers. The research, which includes 46 mammal species, focuses on a biological compound called amylase, which humans and other animals produce to break down starch. The study finds that, in the course of mammalian evolution, the genetic machinery that teaches the body how to make amylase has been something of a chameleon. It has evolved in different ways in different beasts, and it's capable of changing rapidly, possibly in accordance with what animals eat. The study also shows that mammals with starchy diets tend to have more copies of the amylase gene, which carries instructions for building amylase, than mammals that consume little starch (at least among the species studied). The research also presents evidence that evolutionary changes related to amylase—including duplications of the amylase gene and the ability to produce amylase in saliva—may have arisen independently in some different species. Called convergent evolution, this phenomenon often signals a particularly useful adaptation. Overall, the study in eLife paints a colourful picture of the evolutionary history of amylase across mammals, ranging from humans, dogs and house cats to hedgehogs and ring-tailed lemurs, along with baboons that store food in their cheeks.

A new study clarifies how the pursuit of starch may have driven evolution-ary adaptations in mammals.

Did Diet Change Our Genes?

"Amylase is a case where diet may have the potential to change our genes. This is fascinating," says Omer Gokcumen, assistant professor of biological sciences at the University at Buffalo. "The duplications we see in the amylase gene give a very flexible and rapid way in which gene functions can evolve, and this mechanism of evolution is underappreciated." "Past studies have explored the evolution of amylase in select species, such as humans and dogs, but our research takes a broader perspective," says Stefan Ruhl, professor of oral biology in the University at Buffalo School of Dental Medicine. "We examine dozens of mammalian species from different branches of the evolutionary tree, and we see that when it comes to amylase in saliva, genetics and biology may respond to what we eat." Gokcumen, Ruhl and first author Petar Pajic, an oral biology and biological sciences researcher, led the study.

Curiosities

More Carbs

Mammals with starchy diets appear to have adapted, genetically, to stomach more carbs: Of the species in the study, those with starch in their diets generally have more copies of the amylase gene, which carries instructions for making amylase, than animals like carnivores and herbivores whose strict diets tend to exclude starch. Carb-munching humans, house mice, brown rats, dogs, pigs, and boars have lots of copies, while mammals like mountain lions, which subsist on meat, and hedgehogs, which dine on foods such as insects and snails, have few. This is important because the gene is akin to a mould in a factory: the more units you have, the more amylase you can theoretically produce. As for how the extra copies of the amylase gene evolved, "It's like the chicken and the egg—we cannot really tell what came first," Ruhl says. "Starch in the diet may have led to more amylase, and the ability to digest starch may have led to increased starch intake, and so forth." In some cases, close contact with humans—and access to human food—may have spurred an adaptation to starch. The study confirmed past findings from other teams showing that mice and domestic dogs, which live alongside people, have more copies of the amylase gene than their wild cousins (wolves and wild rodents, respectively). The brown rat (Rattus norvegicus)—a species commonly known as the street or sewer rat—also has many copies of the amylase gene.

Dog Drool & Other Spits

Amylase in saliva is more widespread than previously known (some pet dogs produce it, for example): Most amylase is produced in the pancreas, but some animals also secrete it in saliva. The new research finds that this capability is more common than previously known, and proposes salivary amylase as another adaptation that may have arisen through convergent evolution in some species. When scientists tested for amylase in the drool of 22 mammalian species, they found it in 15 species, including six species that were not previously known to have amylase in saliva. Perhaps unsurprisingly, baboons and rhesus macaques that store food in cheek pouches for long periods of time were among the most prolific producers of salivary amylase among the mammals tested. Pet dogs were among the species that were newly identified as salivary amylase producers. While not all dogs have amylase, the research found it in several breeds, such as English cream golden retrievers, Labradors, and pitbulls. "This study provides the most comprehensive picture, to date, on how amylase has evolved in the mammalian lineage at both the genetic level and at the level of protein expression in saliva," says Pajic. "From a broader theoretical

stance, it also reveals how quickly evolution can happen and how something simple, like the food you eat, may drive otherwise unrelated species to evolve similarly."

Sweet, Sweet Starch

For animals who don't store food in their cheeks, the evolutionary advantage of having amylase in saliva is unclear. But Ruhl says one theory is that it helps animals and humans identify starchy foods as desirable to eat. "Humans have a lot of salivary amylase, but why?" he says. "Unlike the baboons who predigest food in their cheek pouches, we humans do not keep food in our mouths long enough for any substantial digestion to happen. One idea is that salivary amylase evolved to help our ancestors detect starch: They would not be able to taste it otherwise. Amylase liberates sugar in starch, and this may help animals develop a taste preference for starch-rich foods like potatoes or corn." Other hypothesised purposes for salivary amylase include cleaning sticky starch residues from teeth: "Amylase in saliva might act as a kind of biochemical toothbrush nature has provided us with," Ruhl says. "It could help to regulate the make-up of the oral microbiome." Additional researchers from the University at Buffalo, the Foundation for Research and Technology in Greece, SUNY Plattsburgh, Cornell University, and the Friedrich-Loeffler-Institut in Germany contributed to the work, which the National Institute of Dental and Craniofacial Research funded.

Futurity, 20 May 2019

http://www.futurity.org

'Death blow': Corals, algae don't acclimatise to more acidic seas

2019-05-29

Coral and algae species subjected to more acidic seawater showed no acclimatisation to the new conditions for over a year, a new study has found, suggesting that vulnerable reefs may not be able adapt fast enough to cope with climate change. With oceans absorbing about 22 million tonnes of carbon dioxide from the atmosphere a day, seas have already become about 30 per cent more acidic over the past two centuries. Shell-forming creatures from oysters to types of plankton are increasingly at risk from the changes, which have been called the "evil twin" - along with higher temperatures - of climate change. Research into coral reefs extends from studying how they cope with higher

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temperature to what happens when waters turn more acidic. A team of scientists exposed four coral and two coralline, or calcifying algal, species to varying ocean acidity levels for a year at the Moorea reef in French Polynesia to test their responses. They found "completely no change over a year", said Christopher Cornwall, a researcher based at Victoria University in Wellington, and an author of the paper published in Nature Climate Change. "We expected that over the course of the year they would slowly get acclimatised," Dr Cornwall said. "In reality they displayed the same responses at the start and the end of the experiment." Since some coral species are known to be more tolerant of lower pH water than others, they would be expected to become more dominant over time as ocean acidification increases - provided they can cope with the marine heatwaves that trigger bleaching events. The stability of the reefs themselves, though, could be undermined if the calcifying algae become less productive, Dr Cornwall said. "The reef itself will start to erode as all of those calcifying organisms are no longer producing that calcium carbonate," Dr Cornwall said. "Ocean acidification is kind of like the death blow after these warming events have been happening ... there's nowhere to get refuge from that." Ken Anthony, principal research scientist at the Australian Institute of Marine Science, said ocean acidification was a "more precise indicator than temperature" of what's happening in the biosphere as CO2 levels rise. On current emissions trajectories, global ocean pH levels could drop to as low as 7.8, Dr Anthony said. Even at 8, all sorts of physiological changes can be expected, including entire ocean food chains being placed at risk. "Even fish larvae's nervous systems get affected [by more acidic water]," he said. "Macro algae also grows faster so that suddenly weedy algae are much more successful in over-growing corals." Dr Anthony, who was not one of the paper's authors, said he was "not surprised by these results", adding it "would have been wonderful" if adaptation had happened so fast. He noted the study had focused on adult corals and algae, and future studies could be extended to look at juvenile and larvae "that are often more susceptible". Longer studies would also be helpful. A separate study by AIMS researchers, meanwhile, has found the relatively pristine and remote coral reefs of Western Australia are increasingly being affected by heat stress and coral bleaching. "For most (75 per cent) reef systems with long-term data (of five to 26 years), mean coral cover is currently at (or near) the lowest on record and a full recovery is unlikely if disturbances continue to intensify with climate change," the paper found. Research should focus on identifying which reef systems are

"least susceptible to future disturbances" and they should be preserved "through networks of protected areas", it said.

The Age, 28 May 2019

http://www.theage.com.au

US Defence Department funds Queensland concussion research study

2019-05-29

Queensland researchers have been tasked by the US Department of Defence to look for genetic links in how well people recover from a concussion. Researchers from QUT's Genomics Research Centre, led by Professor Lyn Griffiths, will conduct the study, which will focus on post-concussion headaches that plague some victims. Professor Griffiths said the US Defence Department was interested in their work because soldiers naturally were exposed to more situations where they could suffer a concussion. QUT researchers are calling for people who've suffered concussions to join a new study into the genetic links with side-effects like headaches. "If you think about the type of work that the Australian and United States armed forces do, they sometimes sustain head injuries in the line of duty, or during training," she said. "They actually put a call out for people interested in looking at post-trauma headache, and since we'd already noticed a number of our patients had been susceptible to concussion, we thought this was something worth looking at. "We have the expertise to deal with this, we have a number of neurologists collaborating with us and we have a number of sporting clubs also collaborating." It's currently known that there is a link between the genes that control ion-flow channels – pathways which feed nutrients to the brain – and the prevalence of post-concussion headache and other side-effects. Professor Griffiths said they would now try to see whether there were any other genetic links to concussion symptoms, during the study, which was slated to last between 18 months and two years. "We've already collected some samples so we've started looking at those genes, but we need a bigger sample size," she said. "What we want to do is not just look at the response to trauma, which is what this is really focusing on, but also we're interested in collecting samples related to susceptibility, why do some people have bad responses to concussion." The research team has already partnered with a number of AFL and Rugby Union clubs to recruit players who've been concussed, especially if they've suffered multiple concussions. However, they are also after members of the public who've suffered one or more head injuries, especially if there was lingering after-

Queensland researchers have been tasked by the US Department of Defence to look for genetic links in how well people recover from a concussion.

effects. Prolonged headaches and migraines are a common after-effect of a head injury, but symptoms such as delayed reaction times, drowsiness and impaired cognitive function are also experienced by some. Professor Griffiths said broad-scale genetic screening would probably not be viable, but they hoped to identify the genetic markers which could let people know they should avoid getting hit in the head – even more so than the rest of us. "Your doctor would know you needed to take more care when doing things like playing sports, you might need to protect your head a bit more," she said. "There's also a particular gene which causes a condition which makes people highly susceptible to bad responses to trivial trauma – there's actually a very good and simple treatment for that, but you need to know it's that specific mutation. "But there may also be other genes which play a role, so there may be different treatments we can use if we know which genes are active and why."

The Age, 23 May 2019

http://www.theage.com.au

Liquid used in e-cigarettes damages cells crucial for a healthy heart

2019-05-29

Another warning that e-cigarettes may weaken your heart

The flavours used in e-cigarettes—especially menthol and cinnamon—damage blood vessel cells and such impacts increase heart disease risk, according to a new study. The study, published today in the Journal of the American College of Cardiology, is the latest to link e-cigarettes, or vaping — which has been touted as a safer alternative to smoking cigarettes—to heart problems. It is the first study to test how e-liquids affect the endothelial cells that line the interior of blood vessels. These cells are crucial in delivering the blood supply to the bodies' tissues and sending cells to promote healthy blood vessels, tissue growth and repair. E-cigarettes are small devices that heat up liquids (usually propylene glycol or glycerol) to deliver as aerosol (vape) mixture of nicotine and flavours. The study comes as e-cigarette use continues to rise. Roughly 1 in 20 U.S. adults now use e-cigarettes but the real growth is happening among youth: use among U.S. high school students went from 11.7 percent in 2017 to 20.8 percent in 2018, according to the U.S. Food and Drug Administration. In addition, about 4.9 percent of middle school students use e-cigarettes, the FDA found. Researchers exposed endothelial cells grown in a laboratory to six different kinds of e-liquids and also examined blood collected from e-cigarette users after they vaped. They found the cells, when exposed to the e-liquids, had a sharp increase in the

types of molecules linked to DNA damage and cell death. The cinnamon and menthol flavours also hampered the ability of cells to promote the growth of new blood vessels. Such changes leave people more susceptible to heart diseases. "Until now, we had no data about how these e-liquids affect human endothelial cells," Dr. Joseph Wu, senior author of the paper, and a researcher and director of the Stanford Cardiovascular Institute and professor of cardiovascular medicine and of radiology, said in a statement. "This study clearly shows that e-cigarettes are not a safe alternative to traditional cigarettes. The cells were less viable in culture, and they began to exhibit multiple symptoms of dysfunction." Wu and colleagues looked at various e-liquid flavours — including fruit flavours, caramel, vanilla, butterscotch, sweet tobacco, menthol and cinnamon. Some contained nicotine, some did not. The cinnamon and menthol flavours were the most toxic to cells, even when there wasn't nicotine in the mixture. "Our findings are concordant with the results of recent studies showing that cinnamon-flavoured e-liquids and aerosols are highly volatile, cytotoxic, and genotoxic to human embryonic cells and adult lung cells," the authors wrote. Beyond the flavours' health impacts, the researchers also found the amounts of nicotine in the blood of both e-cigarette users and traditional smokers were the same after 10 minutes of smoking. "When you're smoking a traditional cigarette, you have a sense of how many cigarettes you're smoking," Wu said. "But e-cigarettes can be deceptive. It's much easier to expose yourself to a much higher level of nicotine over a shorter time period. And now we know that e-cigarettes are likely to have other significantly toxic effects on vascular function as well." The study was limited in that the e-liquids weren't heated, which could alter how the exposed cells react. The research, however, is just the latest linking e-cigarettes to heart impacts. In March, researchers presented a study of nearly 100,000 Americans that found e-cigarette users are more likely to suffer heart attacks and strokes compared to non-users. Another large national study in January of 400,000 Americans reported e-cigarette users have a 70 percent higher risk of stroke and a 60 percent higher risk of heart attack, when compared to non-users. With use rising, health groups continue to push for more strict regulation. A judge this month ordered the FDA to review all U.S. e-cigarette products. The ruling was a response to a federal lawsuit filed by health groups, including the American Academy of Pediatrics and the Campaign for Tobacco-Free Kids, that

alleged the FDA hasn't adequately regulated e-cigarettes and is leaving a generation of U.S kids on the path to nicotine addiction.

Environmental Health News, 27 May 2019

http://www.environmentalhealthnews.org/

World's rivers 'awash with dangerous levels of antibiotics'

2019-05-29

Hundreds of rivers around the world from the Thames to the Tigris are awash with dangerously high levels of antibiotics, the largest global study on the subject has found. Antibiotic pollution is one of the key routes by which bacteria are able develop resistance to the life-saving medicines, rendering them ineffective for human use. "A lot of the resistance genes we see in human pathogens originated from environmental bacteria," said Prof William Gaze, a microbial ecologist at the University of Exeter who studies antimicrobial resistance but was not involved in the study. The rise in antibiotic-resistant bacteria is a global health emergency that could kill 10 million people by 2050, the UN said last month. The drugs find their way into rivers and soil via human and animal waste and leaks from wastewater treatment plants and drug manufacturing facilities. "It's quite scary and depressing. We could have large parts of the environment that have got antibiotics at levels high enough to affect resistance," said Alistair Boxall, an environmental scientist at the University of York, who co-led the study. The research, presented recently at a conference in Helsinki, shows that some of the world's best-known rivers, including the Thames, are contaminated with antibiotics classified as critically important for the treatment of serious infections. In many cases they were detected at unsafe levels, meaning resistance is much more likely to develop and spread. Samples taken from the Danube in Austria contained seven antibiotics including clarithromycin, used to treat respiratory tract infections such as pneumonia and bronchitis, at nearly four times the level considered safe. The Danube, Europe's second-largest river, was the continent's most polluted. Eight per cent of the sites tested in Europe were above safe limits. The Thames, generally regarded as one of Europe's cleanest rivers, was contaminated, along with some of its tributaries, by a mixture of five antibiotics. One site on the river and three on its tributaries were polluted above safe levels. Ciprofloxacin, which treats infections of the skin and urinary tract, peaked at more than three times safe levels. Even rivers contaminated with low levels of antibiotics are a threat, Gaze said. "Even the low concentrations seen in Europe can drive the evolution

Largest global study finds the drugs in two-thirds of test sites in 72 countries

of resistance and increase the likelihood that resistance genes transfer to human pathogens," he says. The researchers tested 711 sites in 72 countries and found antibiotics in 65% of them. In 111 of the sites, the concentrations of antibiotics exceeded safe levels, with the worst cases more than 300 times over the safe limit. Lower-income countries generally had higher antibiotic concentrations in rivers, with locations in Africa and Asia performing worst. They peaked in Bangladesh, where metronidazole, used to treat vaginal infections, was found at more than 300 times the safe level. The residues were detected near a wastewater treatment facility, which in lower-income countries often lack the technology to remove the drugs. Inappropriate disposal of sewage and waste dumped straight into rivers, as was witnessed at a site in Kenya, also resulted in high antibiotic concentrations of up to 100 times safe levels. "Improving the safe management of health and hygiene services in low-income countries is critical in the fight against antimicrobial resistance," said Helen Hamilton, health and hygiene analyst at the UK-based charity Water Aid. The research team is now planning to assess the environmental impacts of antibiotic pollution on wildlife including fish, invertebrates and algae. They expect severe effects. The drug levels in some Kenyan rivers were so high that no fish could survive. "There was a total population crash," Boxall said.

The Guardian, 27 May 2019

http://www.guardian.com

Study Says Sunscreen Enters Bloodstream After One Day of Use

2019-05-29

A pilot study conducted by the Centre for Drug Evaluation and Research, an arm of the US Food and Drug Administration found that several common sunscreen ingredients enter the bloodstream at levels high enough to trigger a government safety investigation. This study was published in JAMA journal also found that these ingredients continued to rise as daily use continued and then remained in the body for at least 24 hours after sunscreen use ended.

The Harmful Chemicals

The four chemicals studied -- avobenzone, oxybenzone, ecamsule and octocrylene -- are part of a dozen that the FDA recently said needed to be researched by manufacturers before they could be considered "generally regarded as safe and effective." "Studies need to be performed to evaluate

Study Says Sunscreen Enters Bloodstream after One Day of Use

this finding and determine whether there are true medical implications to absorption of certain ingredients," said Yale School of Medicine dermatologist Dr. David Leffell, a spokesman for the American Academy of Dermatology. He added that in the meantime, people should "continue to be aggressive about sun protection."

The New Sunscreen Study

The new FDA study enrolled 24 healthy volunteers who were randomly assigned to a spray or lotion sunscreen that contained avobenzone, oxybenzone or octocrylene as ingredients or a crème sunscreen that contained the chemical ecamsule. The volunteers were asked to put their assigned sunscreen on 75% of their bodies four times each day for four days. Thirty blood samples were taken from each volunteer over seven days. Of the six people using the ecamsule cream, five had levels of the chemical in their blood considered statistically significant by the end of day one. For the other three chemicals, especially oxybenzone, all of the volunteers showed significant levels after the first day. "Looking through the results tables of the study, one thing about oxybenzone stood out," Andrews said. "Oxybenzone was absorbed into the body at about 50 to 100 times higher concentration than any of these other three chemicals they tested." In 2008, the US Centres for Disease Control and Prevention analysed urine samples collected by a government study and found oxybenzone in 97% of the samples. Since then, studies have shown a potential link between oxybenzone and lower testosterone levels in adolescent boys, hormone changes in men, and shorter pregnancies and disrupted birth weights in babies, but researchers caution about assuming association.

The European Union has mostly replaced oxybenzone in its sunscreen products with newer, more protective substances that block out more of the dangerous UVB and UVA rays. But those newer products have not passed the safety tests needed for FDA approval. So oxybenzone remains in use.

Research Urgently Needed

In an editorial accompanying the new study, former FDA Chairman Dr. Robert Califf assured readers that just because the research found chemical levels "well above the FDA guideline does not mean these ingredients are unsafe." Califf said next steps would be appropriately designed clinical trials by industry to test safety and determine the optimal dose to prevent skin cancer while balancing risk and benefit. In addition, he said, "an urgent question involves absorption in infants and

children, who have different ratios of body surface area to overall size and whose skin may absorb substances at differential rates." The Personal Care Products Council's statement said the industry has offered "state-of-the-art toxicological safety approaches as alternatives" to the FDA's testing method. "We look forward to our continued work with the FDA to ensure that consumers have access to products containing a broad variety of sunscreen active ingredients," Kowcz said. While science continues to answer questions about sunscreen, Califf and other experts call for the public to continue to protect their skin from the dangerous rays of the sun. This study was published in the medical journal JAMA.

Special Chem, 7 May 2019

https://cosmetics.specialchem.com

Fungus that draws gold from its surroundings discovered in Western Australia

2019-05-29

Interaction that could signal new gold deposits 'had to be seen to be believed', CSIRO researcher says

Fungus that draws gold from its surroundings has been discovered in Western Australia, stunning scientists who say it could signal new deposits. Found near Boddington, south of Perth, the strain of the Fusarium oxysporum fungus attaches gold to its strands by dissolving and precipitating particles from the environment. There may be a biological advantage in doing so, as the gold-coated fungus was found to grow larger and spread faster than those that don't interact with the precious metal. "Fungi are well-known for playing an essential role in the degradation and recycling of organic material, such as leaves and bark, as well as for the cycling of other metals, including aluminium, iron, manganese and calcium," CSIRO researcher Dr Tsing Bohu said. "But gold is so chemically inactive that this interaction is both unusual and surprising – it had to be seen to be believed." Bohu is undertaking further analysis and modelling to understand why the fungus is interacting with gold, and whether it is an indication of a larger deposit below the surface. Australia is the world's second-largest gold producer, and while volumes broke records last year, output is forecast to fall in the near future unless new deposits are found. Chief research scientist Dr Ravi Anand said the industry was already using gum leaves and termite mounds, which can store tiny traces of gold, to guide exploration sampling. "We want to understand if the fungus we studied ... can be used in combination with these exploration tools to help industry to target prospective areas," Anand said. Commonly found in soils around the world, the species is not something

prospectors should look for as the gold particles can only be seen with a microscope.

The Guardian, 24 May 2019

http://www.guardian.com

How antibiotic resistance is driven by pharmaceutical pollution

2019-05-29

The Medak district, to the north-west of Hyderabad in southern India, was once a pristine landscape. People came to bathe in the cool, refreshing lakes and streams. These days the air is foul. With every breath, chemicals irritate your lungs and, after a while, you feel nauseous. The colour of the water doesn't help: it ranges from bright orange to deep brown, and is often covered in a thick layer of white foam. The reason for this blight is not well hidden. Behind high walls and barbed wire fences, factories churn out cheap drugs for the global market. Tall chimneys belch black smoke and tankers trundle along dirt tracks under cover of darkness to dump toxic chemical waste. "It's like a slow poison," says Batte Shankar, the head of one village we visited. "When you Europeans are taking these antibiotics to heal, it is good for you. But we are suffering." However, when we came to the region to investigate the environmental situation and its consequences for the health of the people who live there, we were also aware of something even more insidious. The foetid lakes and streams contain extraordinarily high concentrations of antibiotics, creating reservoirs of the drug-resistant pathogens that kill hundreds of thousands of people every year. Some suspect these places might even be incubating new superbugs that could rapidly spread around the world. Now the challenge is to figure out whether people in this part of India are being harmed by antibiotic pollution, and the extent to which global health is in the firing line. It is also part of a last-ditch attempt to convince the authorities in India and elsewhere to take the problem seriously before it is too late. When the first tranche of antibiotics were introduced to the world in the 1950s, they were a revelation. Almost overnight, people stopped dying of common bacterial infections. But then the bacteria fought back. When you treat an infection, microbes carrying genes that make them immune to such drugs survive. If bacteria repeatedly encounter the same antibiotic, natural selection ensures that those microbes with resistance come to dominate the population – and the drugs stop working. That is how we ended up where we are today, with antibiotic resistance rising to dangerously high levels across the world and our ability to

Factories in India making cheap antibiotics for the world are dumping their waste, with grim consequences for people living nearby – and global health too

treat common infectious diseases under serious threat. In Europe, drug-resistant infections are responsible for the deaths of 33,000 people every year, according to a recent study published in The Lancet. Worldwide, the annual death toll attributed to antibiotic resistance is estimated to be as high as 700,000 – and it is expected to get a lot higher. A 2016 report suggested that, by 2050, 10 million people will die each year as a result of the problem. The crisis is typically attributed to the excessive use of antibiotics. Over the past decade or so, environmental contamination has also come under the spotlight. When we take antibiotics, we excrete somewhere between 30 and 90 per cent of the active compound and it is flushed down the toilet. Antibiotics used on farm animals also end up in rivers, lakes and groundwater.

However, the one source that has largely been overlooked is the waste produced by the pharmaceutical factories that make the drugs in the first place. Many of those factories are in China and India, where cheap labour is abundant and environmental regulations tend to be scarce. The Medak district is a good example. It has become India's main pharmaceutical hub. More than 150 drug manufacturers have factories in the area, many of which produce antibiotics. Almost inevitably, the industry has taken its toll on the surroundings. When we toured the area last October with Anil Dayakar, an activist from an Indian environmental campaign group called Gamana, we saw it first-hand. Gaddapotharam Lake, for example, was once used to irrigate rice paddies. It is now so contaminated that farmers have abandoned the area. We also visited Isnapur Lake, right in front of a cluster of pharmaceutical plants, where the smell is so foul that, within minutes, you feel physically sick. Here, Dayakar pointed out tracks left in the muddy banks by the tankers that come at night to dump industrial waste rather than taking it to the local treatment plant. Everywhere you look, you see pollution from the pharmaceutical factories. It wasn't until Joakim Larsson began to investigate further, however, that Dayakar and his colleagues really came to understand the full extent of the problem. An environmental pharmacologist from the University of Gothenburg in Sweden, Larsson has spent most of his career exploring the impact of pharmaceutical consumption. "Basically, it's about how the environment is being contaminated through pee and poo," he says. In 2007, he also turned his attention to pollution from manufacturing, which brought him to Hyderabad. He wanted to see just how much of the antibiotic compounds being produced end up in the local lakes and streams. What he found was astonishing. In effluent at the local industrial waste-water treatment plant, the concentration of a common antibiotic called ciprofloxacin was 1000 times higher than is required to kill the bacteria

it targets – and a million times higher than the levels typically found in sewage outflows elsewhere in the world. "There was enough ciprofloxacin in the effluent leaving the plant each day to treat everyone in a city of 45,000 people," says Larsson. The concentrations were so high, in fact, that Larsson had the samples independently analysed because he was worried that no one would believe the results. When the confirmation came, the upshot was clear. "After this study, we knew antibiotics were not only contaminating the environment through excrement," says Larsson. They were also being released in large amounts as a result of pharmaceutical production. Two years later, Larsson and his colleagues took samples from the stream running down from the same waste-water treatment plant, two nearby lakes that weren't thought to be contaminated and wells in six surrounding villages. Again, he found exceptionally high concentrations of drugs in several of the wells and in both lakes. When we visited the Telangana State Pollution Control Board, which is responsible for preventing water pollution in the Medak area, it admitted that illegal dumping occurs. But it denied this was out of control. And it told us it isn't obliged to look for antibiotics in the environment. "This is not required by the national standards and we don't have the facility for that," says Sadiq Ali, who leads the board's laboratory in Hyderabad. Surprisingly, the same is true in Europe. Rules there cover some polluting substances emitted in the air or water, but not active pharmaceutical ingredients, says Kia Salin, an environmental strategist at the Swedish Medical Products Agency. "The water contained such a high concentration of antibiotics, researchers feared no one would believe their results". The lack of regulation is largely down to lobbying. Several of the most prominent pharmaceutical companies have openly and repeatedly said that, while they recognise the need to address pollution from manufacturing, they prefer a "voluntary" approach. Even so, this sorry state of affairs persists in part because the link between antibiotic pollution and the rise of drug-resistant pathogens is still hard to assess. The doctors we met in Hyderabad estimate that between 30 and 40 per cent of the patients visiting their hospitals carry multidrug-resistant microbes. Unfortunately, it isn't easy to demonstrate a direct connection between pollution and individual infections. "It is true that we don't know to what extent the presence of antibiotics in the environment leads to health problems through the development of antimicrobial resistance," says Larsson.

Superbug soup

What is beyond doubt, however, is that the environment surrounding these factories harbours plenty of the genetic material that makes

infectious bacteria resistant. In 2011, Larsson and his colleagues published a study showing that resistance genes made up a worryingly high percentage of the DNA samples taken from three sites downstream of a waste-water plant in the Patancheru industrial area, another cluster of pharmaceutical factories. What Larsson really wanted to find out was whether people living near the factories carried more resistant bacteria than people elsewhere. The plan was to analyse faecal samples from people living in and around Patancheru, and from those further away, to investigate the extent to which they carried bacteria with resistance to ciprofloxacin. But the researchers were too late. "The resistance was already everywhere, not only in Patancheru, but all around Hyderabad," says Larsson. "It spreads so quickly that it's difficult to show when and where resistance appears in the first place." Ultimately, it may be impossible to track down the source of resistance affecting individuals. Over the past few years, however, several studies published by Larsson and others have strongly indicated that antibiotic contamination promotes the propagation of resistance genes and accelerates their spread among bacteria. In 2015, for instance, Larsson and his colleagues investigated Kazipally and Asanikunta lakes in the same part of India. They are known to be heavily polluted with a group of antibiotics known as fluoroquinolones, which includes ciprofloxacin. The researchers sampled sediments from both lakes and measured the proportions of resistant bacteria they hosted. The results were alarming: 50 per cent of the bacteria there were resistant to ciprofloxacin compared with just 2 per cent in Swedish lakes and unpolluted Indian lakes. The implications aren't hard to fathom. When bacteria reside in highly concentrated antibiotic soups like those around Patancheru, any without resistance will quickly die off. Only those with resistance genes will survive and multiply. "The antibiotics in the industrial waste [around Patancheru] are selecting for resistance," says Larsson. "That is beyond reasonable doubt." And even if the resistance genes aren't present in human pathogens to begin with, they can easily end up in them. In Kazipally Lake, the researchers also identified 11 different kinds of self-replicating rings of DNA, known as plasmids, that were carrying resistance genes. Plasmids are known to play a key role in the spread of antibiotic resistance because they facilitate horizontal gene transfer. This is when genetic material from one microbe ends up in another organism without the need for traditional "vertical" transmission of DNA from parent to offspring. So, resistance genes don't have to be inherited to spread. "Do people living close to the antibiotic factories carry more resistant superbugs than others?" Due to the strong selection pressure they create, high concentrations of antibiotics in the environment could also give rise to new resistance genes that may

render yet more antibiotics useless. In the various samples from lakes and streams around Hyderabad, Larsson and his colleagues found many previously unidentified resistance plasmids. It is possible, then, that the area is harbouring the next New Delhi metalloenzyme (NDM-1), a novel resistance gene that makes microbes immune to a class of antibiotics called carbapenems. It was discovered in a man in Sweden in 2008 after a trip to India, before rapidly spreading around the world. Earlier this year, it showed up in the Arctic.

Legislative inaction

For those living close to the pharmaceutical factories around Hyderabad, the situation is excruciating. In July 2018, community activists from the region sent a letter to the European Commission. "[We] urge you to take action and address the grave environmental and human health crisis currently unfolding in India linked to the production of pharmaceuticals for global markets," they wrote. Action is long overdue. In 2016, 13 drugs companies signed a declaration for collective action on antibiotic resistance, committing to review their manufacturing and supply chains to control pollution. But that is just a "road map". It isn't legally binding, and international authorities have been slow to force the industry's hand on the issue. In March this year, the European Commission unveiled its Strategic Approach to Pharmaceuticals in the Environment. According to the non-profit European Public Health Alliance, however, the initiative "shies away from considering new legislative measures". If antibiotic pollution continues unabated in developing nations such as India, it will be a huge problem and not only in such places. The case of NDM-1 shows how widely new forms of resistance can spread. And one recent study revealed that 90 per cent of tourists visiting India went home carrying multidrug-resistant bacteria they didn't have before the trip. But Hyderabad's hinterlands aren't going to stop churning out antibiotics any time soon. In March 2018, local officials announced the construction of Pharma City, a new pharmaceutical park at Mucherla, south of the city, that will host between 900 and 1000 companies. Indeed, local authorities promote this latest venture with the slogan, "minimum inspection, maximum facilitation". So, it seems that despite the best efforts of Larsson and others, for the time being at least, the region will continue to pay a high price for the cheap antibiotics its factories produce.

New Scientist, 22 May 2019

http://www.newscientist.com/

Curiosities

A Man's Love of Licorice Tea Landed Him in the Emergency Room

2019-05-29

One man's hot tea habit turned out to be much less relaxing than he hoped, according to his doctors. An 84-year-old Canadian ended up in the emergency department with a serious case of high blood pressure, headache, and chest pain, with the only likely cause of his symptoms being his two weeks straight of drinking homemade licorice root tea. But it's hardly the first-time licorice has been blamed for blood pressure problems. The man's story was detailed in a case study published in the Canadian Medical Association Journal. According to the study, the man had long had hypertension and a history of cardiovascular disease, but he had been able to keep his blood pressure in check as recently as his last medical check-up. A week before he visited the hospital, though, he noticed that his blood pressure had begun climbing, and nothing he did seemed to help. By the time doctors saw him, he was already suffering from physical symptoms such as chest pain, fatigue, and headache. And it's likely things could have gone much worse if he hadn't gotten help right then and there. "In his case, the blood pressure was so high that it led to him having heart failure, swelling of the legs, and some abnormalities with his electrolytes, like low potassium," study author Laurence Green, an internal medicine physician at McGill University Health Centre, told Gizmodo by phone. There was no apparent reason why his blood pressure had spiralled out of control. But eventually, the man volunteered that he had been drinking one to two glasses of homemade tea brewed from licorice root for two weeks before his admission to the hospital. Licorice (derived from the plant Glycyrrhiza glabra) is part of a drink called erk sous, popular in some countries including Egypt and around the Muslim holiday of Ramadan. Thankfully, once he stopped drinking the licorice tea and starting taking intensive blood pressure drugs, the man steadily recovered. He left the hospital in good health after two weeks, and a check-up three weeks later found that his blood pressure was back to manageable. The man's pre-existing health certainly contributed to the danger he was in. But doctors have long known that licorice can cause or worsen high blood pressure in people, and as recently as 2017, the Food and Drug Administration warned that people over the age of 40 should avoid eating too much licorice candy. According to the agency, eating more than two ounces of black licorice candy a day for two weeks straight can raise the risk of developing an irregular heart rhythm or arrhythmia in older people. "This is not a new discovery," Green noted. "It's more of an episodic reminder to doctors that licorice can cause these symptoms

One man's hot tea habit turned out to be much less relaxing than he hoped, according to his doctors.

and that they should be aware of that." The culprit behind licorice's effect on blood pressure is the compound that gives it its slightly sweet taste, called glycyrrhizin (or glycyrrhizinic acid). In high enough doses, it causes our cells to retain more water than they should and our body's potassium levels to plummet, the net result of which drives up blood pressure. According to his doctors, the man did know about the risks of licorice and high-blood pressure, but he simply didn't suspect the tea when his symptoms first arose. While the case study is intended for doctors, Green said that there are things the public should keep in mind as well, particularly those of us who love their red Twizzlers. "Many people think they're eating licorice, but they're probably not. That red candy that's sort of shaped like licorice? There's no licorice in there whatsoever. It has to be the black licorice. And even then, if it's taken in moderation, and you don't have high blood pressure or heart problems, you should be fine," Green said. It is theoretically possible for perfectly healthy people to develop licorice-related high blood pressure or other related problems, he added, but it would take some pretty huge quantities of licorice to pull off. So as long as you don't do that, you're in the clear. After all, of the ways to go, death by licorice binge might be one of the most embarrassing.

Gizmodo, 28 May 2019

http://gizmodo.com

Is love just a chemical reaction?

2019-05-29

Blame it on your hormones all you like, although they play a part in taking you to lovey-dovey town, there are also non-chemical factors involved in whether we fall in love.

People who are in love have higher levels of several key hormones. For example, oxytocin and vasopressin – two hormones produced in a region of the brain called the hypothalamus – cause stronger feelings of attachment. The development of hormones that encourage us to form committed relationships makes sense from an evolutionary perspective: our ancestors would have been more likely to successfully raise, feed and protect their children if both parents worked together. But does this mean that love is just a chemical trick being played on our brains? Oxytocin has been shown to increase the amount of time you spend gazing into the eyes of your loved one, and it also boosts your ability to read someone's emotions. Some perfume manufacturers have tried to exploit this by adding oxytocin to their scents, but the dosage is too low to have any effect. It's possible that a more thorough understanding of the way different hormones interact may eventually allow us to create a potion that increases our chances of falling in love. But things like shared history,

values and cultural reference points also play a part in whether we fall in love, and these things aren't directly controlled by our hormones.

Science Focus, May 2019

http://www.sciencefocus.com

Even dim candlelight before bed is bright enough to disrupt sleep

2019-05-29

You may have heard that bright lighting in the evenings can disrupt your sleep. But it turns out some of us are more sensitive to this effect than others. A new study suggests people's threshold for their body clock hormones being disturbed by late-night light can vary by more than fifty-fold. "For some people, a dim reading light might as well be daylight, and for others it might as well be darkness," says Sean Cain at Monash University in Melbourne. Our bodies experience many biochemical fluctuations over the day, with a key regulator being a hormone called melatonin. This naturally starts rising in the evening, which promotes sleepiness, but the surge can be delayed by artificial lights, especially the blue-enhanced illumination from phones, computers and TVs. Some believe we can improve our sleep patterns and health by lowering light exposure in the evening and boosting it during the day. Most previous studies into the effects of light levels on melatonin have studied groups of people, averaging out their reactions. But Cain's team looked at the individual responses to evening light among 55 men and women. The volunteers had to keep a strict sleep schedule for up to eight weeks based on their preferred bedtime. One night a week, they came into the lab and were exposed to a certain light level – from dim to bright, in a random order – starting four hours before bedtime, and their melatonin levels were measured. People had markedly different responses. In the most sensitive person, a very dim light level of 6 lux, equivalent to a few candles, was enough to halve their melatonin levels – which previous work suggests would delay sleep onset by 30 to 60 minutes depending on the person. For the least sensitive person the same response required 350 lux, equivalent to harsh fluorescent lights in a store, brighter than would be found at home. On average, the light level required for such disruption was also lower than suggested by previous work. But the researchers did not measure if people's sleep actually was delayed in this study. There is no easy test for light sensitivity, but when applying this at home, "it's best to err on the side of caution," says Cain. He has installed home lighting that

Can't go out like a light? Sleep loss could be due to light sensitivity before bed

automatically becomes low and less blue from dusk onwards. "I keep my lights as dim as I can without bumping into furniture."

New Scientist, 27 May 2019

http://www.newscientist.com/

Earth's methane emissions are rising and we don't know why

2019-05-29

Levels of a powerful greenhouse gas jumped again last year, continuing a surge in the past few years that researchers still cannot fully explain. Atmospheric concentrations of methane climbed by 10.77 parts per billion in 2018, the second highest annual increase in the past two decades, according to provisional data released recently by US agency NOAA. Methane is a shorter-lived but much more powerful greenhouse than carbon dioxide. The amount finding its way from human and natural sources, which can include everything from oil and gas wells to wetlands, has been rising since 2007. The rate has accelerated in the past four years. Researchers warned earlier this year that if methane levels keep increasing at current rates then the Paris climate deal's goals – of limiting global warming to 2°C and pursuing efforts to keep below 1.5°C – would be very difficult to meet. Euan Nisbet of Royal Holloway University of London says researchers are very worried about the latest rise. Perhaps even more concerning is the fact no one is entirely sure what is driving the trend. "The disturbing aspect is, we do not know which processes are responsible for methane increasing as rapidly as it is," says Ed Dlugokencky of the US's National Oceanic and Atmospheric Administration. Keith Shine at Reading University echoes that view. "The fact that growth rates in the atmospheric concentrations of methane are approaching the levels we saw in the 1980s, after a period of relatively slow growth, is deeply concerning. The fact that we don't understand the reasons for this surge deepen that concern." One possibility is that a warmer world is causing more methane to be released from wetlands in the tropics, fuelling even more warming. That would suggest a feedback loop is underway. "I'm not sure but it looks as if the warming is feeding the warming," says Nisbet. More evidence is needed to prove the idea though. Rebecca Fisher of Royal Holloway University of London says: "We still do not know whether the growth is primarily an increase in 'natural' emissions, such as from warmer or wetter wetlands, or increased anthropogenic emissions such as rice agriculture or fossil fuels." It could also be a change in the atmospheric sinks of methane or, she says, most likely a combination of reasons. The methane surge

Levels of a powerful greenhouse gas jumped again last year, continuing a surge in the past few years that researchers still cannot fully explain.

gains added significance from the fact researchers have been discovering in recent years that the gas has a more powerful warming effect than previously thought. In the first report by the UN climate science panel, in 1990, 21 tonnes of methane was considered to have the same global warming potential as one tonne of carbon dioxide. That was upgraded to 28 tonnes of methane in the most recent major report, and could rise as high as 35 tonnes in the next big assessment in 2022.

New Scientist, 24 May 2019

http://www.newscientist.com/

A Special Type of Honey Might Be Just as Effective For Cold Sores as Regular Creams

2019-05-29

If you're among the one in three readers prone to frequent cold sores, there's every chance you keep a tube of virus-busting acyclovir cream in your bathroom cabinet in anticipation of that next blister. Turns out medical grade honey made from kānuka (Kunzea ericoides) blossoms might be just as effective. Pending further research, the find could offer those who suffer the effects of the herpes virus a wider choice in treatments. A clinical trial led by the Medical Research Institute of New Zealand (MRINZ) tested claims that a more natural alternative to antiviral creams could do just as good a job at reducing the amount of time a cold sore spends on your face. It's fair to say that most of you have the herpes simplex virus in your body. And of those who do, up to nearly half will experience the uncomfortable, awkward eruption of the virus in the form of a blister on an outer mucosal membrane, such as the nose or lips. Quickly attacking it with a cream containing acyclovir should speed up the healing time by a day or two. It doesn't sound like much, but that relief is a welcome one, not to mention less time blisters have for shedding the virus. While it's usually a fairly benign treatment, acyclovir isn't completely free of potential side-effects. There are also plenty of people who simply don't like the thought of rubbing on something that sounds like a Harry Potter spell. Meanwhile, honey has been used for centuries to treat infections, falling aside mid-last century once the silver bullet of broad-spectrum antibiotics took centre stage. The growth of a medical counter-culture in recent decades has revived interest in this medicinal classic, with claims that honey can boost energy, improve sleep, fight infections, and 'detox' your liver. Pulling apart the truth from the wishful thinking requires time and effort, not to mention a whole lot of dollars. While independent and private research companies often fund searches for potential chemical

treatments in nature's pharmacopoeia, proponents of alternative therapies can be reluctant to expose their potential remedies to scientific scrutiny. "There are significant barriers relating to both cost and quality assurance in order to meet strict New Zealand regulatory requirements for clinical trials and, of course, there's always the risk the results may prove negative," says medical researcher Alex Semprini. The remedy being evaluated isn't just any old store-bought jar of bee spew, but is of medicinal grade, meaning it is sterilised and theoretically contains more antimicrobial ingredients. You might have come across a common medicinal honey based on the mānuka plant (Leptospermum scoparium), a myrtle that's endemic to New Zealand and Australia. Kānuka isn't all that different, made from a botanical cousin that's found throughout New Zealand's lowland and mountain scrublands, and on the margins of forests. The researchers combined kānuka honey with glycerol and compared the mix with a cream of 5 percent acyclovir. Each topical treatment was then allotted randomly to 952 volunteers, who were instructed to apply treatment within the first 72 hours of noticing an outbreak, repeating it five times a day until the blisters vanished. Tallying up the figures, those who used the acyclovir on average experienced symptoms for 8 to 9 days, and had an open blister for about 2 days. For those who used honey, the results weren't significantly different, suggesting there just might be something to these claims after all. "This means that patients with a preference for natural and alternative medicines, as well as pharmacists who sell these treatments, can have confidence in the effectiveness of this kānuka honey formulation as a further treatment option for cold sores," says Semprini. That confidence comes with a couple of caveats. For one thing, this wasn't one of those gold-standard, double-blind kinds of clinical trial. That doesn't make it useless, but since volunteers could easily tell whether they were rubbing in acyclovir or honey-flavoured glycerol, the results could be swayed. Ideally, all science funding would be independent, bias free, and rain freely from the skies. We can live in hope. In this case a New Zealand company called HoneyLab put their money where their mouth is and contributed funding to look into a remedy they sell. So, we have every reason to be cautious. But if we take this in context with other studies suggesting honey might contain a trove of compounds worth analysing for medicinal value, we shouldn't be too quick to dismiss the study out of hand either. Further research could help identify the mechanisms potentially responsible for the honey's effects on herpes infections, and maybe even lead to more powerful therapies than we

Curiosities

have now. One in three of you would be grateful for that sweet news. This research was published in BMJ Open.

Science Alert, 25 May 2019

http://www.sciencealert.com.au

Technical Notes

CHEMWATCH

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

ENVIRONMENTAL RESEARCH

Synergetic effects of novel aromatic brominated and chlorinated disinfection by-products on Vibrio qinghaiensis sp.-Q67

Marine natural products as source of new drugs: a patent review (2015-2018)

Recent advances in the biocontrol of Xanthomonas spp

Volatiles from Different Instars of Honeybee Worker Larvae and Their Food

Antibiotics in corals of the South China Sea: Occurrence, distribution, bioaccumulation, and considerable role of coral mucus

MEDICAL RESEARCH

Biosafety evaluation of Janus Fe3O4-TiO2 nanoparticles in Sprague Dawley rats after intravenous injection

Complement regulatory protein CD59a plays a protective role in immune liver injury of trichloroethylene-sensitized BALB/c mice

Bradykinin contributes to immune liver injury via B2R receptor-mediated pathways in trichloroethylene sensitized mice: A role in Kupffer cell activation

Benzene metabolite hydroquinone promotes DNA homologous recombination repair via the NF-κB pathway

Exposure to MPA-capped CdTe quantum dots causes reproductive toxicity effects by affecting oogenesis in nematode Caenorhabditis elegans

OCCUPATIONAL RESEARCH

Maternal circadian disruption is associated with variation in placental DNA methylation

Biochemical study on occupational inhalation of benzene vapours in petrol station

Occupational Radiation Protection Aspects of Alkaline Leach Uranium in Situ Recovery (ISR) Facilities in the United States

Technical Notes

Effects of oxidative stress on blood pressure and electrocardiogram findings in workers with occupational exposure to lead

Animal production, insecticide use and self-reported symptoms and diagnoses of COPD, including chronic bronchitis, in the Agricultural Health Study

PUBLIC HEALTH RESEARCH

Non-Hodgkin lymphoma risk and organophosphate and carbamate insecticide use in the north American pooled project

Peak Exposures in Epidemiologic Studies and Cancer Risks: Considerations for Regulatory Risk Assessment

Elucidating Conserved Transcriptional Networks Underlying Pesticide Exposure and Parkinson's Disease: A Focus on Chemicals of Epidemiological Relevance

Low-cost photoionisation sensors as detectors in GC × GC systems designed for ambient VOC measurements

Early lead exposure and pubertal development in a Mexico City population