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*** While Chemwatch has taken all efforts to ensure the accuracy of information in this publication, it is not intended to be comprehensive or to render advice. Websites rendered are subject to change.**

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ASIA PACIFIC

List of priority existing chemicals

2019-08-16

Requirements under the Industrial Chemicals (Notification and Assessment) Act 1989 (the Act) require the Director of National Industrial Chemicals Notification and Assessment Scheme (NICNAS) to maintain a list of priority existing chemicals, and a list of chemicals that have been priority existing chemicals. In the August edition of the Chemical Gazette, NICNAS has published an updated copy of these lists. The tables detail the nature of the assessment (full or preliminary). Preliminary assessments are denoted by an asterisk (*). Assessments are conducted to determine the potential risks to the public, worker health and/or the environment associated with all industrial uses of the chemical in Australia, unless indicated otherwise. Assessments may be conducted for several chemicals as a group: these group assessments are indicated by the title of the assessment.

Table 1: Current priority existing chemicals

Chemical	CAS number	Declaration date
Full risk assessments		
Pentabromodiphenyl ether	32534-81-9	January 2006
Tetrabromobisphenol A	79-94-7	June 2005

More information on current priority existing chemicals can be found on NICNAS's PEC declarations page.

Table 2 indicates the publication date of the assessment reports for which the declaration of the priority existing chemical was revoked. All published priority existing chemical reports are available from NICNAS, and electronic copies are available on our PEC assessments page.

Table 2: Priority existing chemical reports

Assessment number	Chemical	CAS number	Publication date
Full risk and preliminary assessments			
PEC/41	Decabromodiphenyl ether (decaBDE)	1163-19-5	May 2019
PEC/40	Butylbenzyl phthalate (BBP) ¹	85-68-7	July 2015

Requirements under the Industrial Chemicals (Notification and Assessment) Act 1989 (the Act) require the Director of National Industrial Chemicals Notification and Assessment Scheme (NICNAS) to maintain a list of priority existing chemicals, and a list of chemicals that have been priority existing chemicals.

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Table 2: Priority existing chemical reports

Assessment number	Chemical	CAS number	Publication date
PEC/39	Diisodecyl phthalate (DIDP) ^{1,4}	68515-49-1 26761-40-0	May 2015
	Di-n-octyl phthalate (DNOP) ^{1,4}	117-84-0	
PEC/38	Di(methoxyethyl) phthalate (DMEP) ¹	117-82-8	May 2014
PEC/37	Dimethyl phthalate (DMP) ¹	131-11-3	January 2014
PEC/36	Dibutyl phthalate (DBP) ¹	84-74-2	November 2013
PEC/35	Diisononyl phthalate(DINP) ¹	28553-12-0, 68515-48-0	September 2012
PEC/34	Hexabromocyclododecane (HBCD)	25637-99-4 3194-55-6	June 2012
PEC/33	Diethyl phthalate(DEP) ¹	84-66-2	November 2011
PEC/32	Diethylhexyl phthalate (DEHP) ¹	117-81-7	July 2010
PEC/31	Sodium cyanide ²	143-33-9	February 2010
PEC/30	Triclosan	3380-34-5	January 2009
PEC/29	Lead compounds used in industrial surface coatings and inks ^{3,4}	Various (15 chemicals)	September 2007
PEC/28	Formaldehyde	50-00-0	November 2006
PEC/27	Tris(2,3-dibromopropyl) phosphate (TBPP)	126-72-7	November 2005
PEC/26	Sodium alkylbenzene sulfonate anti-valve seat recession (AVSR) additive	78330-12-8	February 2004
PEC/25	Alkyl phosphate anti-valve seat recession (AVSR) additive	Exempt	July 2003
PEC/24	Methylcyclopentadienyl manganese tricarbonyl (MMT)	12108-13-3	June 2003
PEC/23	Acrylamide	79-06-1	May 2002
PEC/22	Limonene ^{4,6}	5989-27-5 5989-54-8 138-86-3	May 2002
PEC/21	Benzene	71-43-2	September 2001
PEC/20	*Polybrominated flame retardants (PBFRs) ⁴	Various (30 chemicals)	June 2001

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Table 2: Priority existing chemical reports

Assessment number	Chemical	CAS number	Publication date
PEC/19	*Hydrofluoric acid (HF)	7664-39-3	June 2001
PEC/18	Ammonium, potassium and sodium persulfate in hairdressing ⁴	7727-54-0 7727-21-1 7775-27-1	June 2001
PEC/17	*Trisphosphates ⁴	Various (6 chemicals)	June 2001
PEC/16	*Short chain chlorinated paraffins (SCCPs) ⁴	Various (6 chemicals)	June 2001
PEC/15	*Tetrachloroethylene	127-18-4	June 2001
PEC/14	<i>ortho</i> -Dichlorobenzene	95-50-1	February 2001
PEC/13	<i>para</i> -Dichlorobenzene	106-46-7	December 2000
PEC/12	*Glycolic acid in cosmetics ³	79-14-1	April 2000
PEC/11	N-vinyl-2-pyrrolidone (NVP)	88-12-0	February 2000
PEC/10	*Acrylonitrile	107-13-1	February 2000
PEC/9	Chrysotile (white asbestos)	12001-29-5	February 1999
PEC/8	Trichloroethylene	79-01-6	March 2000
PEC/7	1,4-Dioxane	123-91-1	June 1998
PEC/6	2-Butoxyethanol in cleaning products	111-76-2	October 1996
PEC/5 SNA	**Sodium ethyl xanthate	140-90-9	February 2000
PEC/5	Sodium ethyl xanthate	140-90-9	May 1995
PEC/4 SNA	**2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123)	306-83-2	July 1999
PEC/4	2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123)	306-83-2	March 1996
PEC/3	Glutaraldehyde	111-30-8	July 1994
PEC/2	Savinase – Proteolytic enzymes in detergent ⁴	Various (4 chemicals)	February 1993
PEC/1 SNA	**Triglycidylisocyanurate (TGIC)	2451-62-9	February 2001
PEC/1	Triglycidylisocyanurate (TGIC)	2451-62-9	April 1994
	Octabromodiphenyl ether ⁵	32536-52-0	Not applicable
	Octabromodiphenyl ⁵	27858-07-7	Not applicable
	Decabromobiphenyl ⁵	13654-09-6	Not applicable

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¹ Assessment restricted to public health risk from use in cosmetics, children's toys and childcare articles.

² Assessment restricted to environmental risk.

³ Assessment restricted to human health risk.

⁴ Group assessments. Refer to PEC report for CAS numbers.

⁵ No applications were received for PEC assessment and; therefore, the chemicals were removed from the Australian Inventory of Chemical Substances (AICS).

⁶ CAS Number 138-86-3 (dl-limonene) replaces the former CAS Number 7705-14-8.

* Preliminary assessments.

**SNA Secondary Notification Assessment

NICNAS Chemical Gazette, 6 August 2019

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

Legislative reporting requirements

2019-08-16

The Australian Pesticide and Veterinary Medicine Authority (APVMA) Compliance and Monitoring has reminded all registrants and manufacturers of their obligations and legislative reporting requirements, regarding the following:

Annual return of actives

Under section 69E of the Agricultural and Veterinary Chemicals (Administration) Act 1992, all holders of approvals and registrations must report the amount of active constituents imported, manufactured or exported.

Reporting opens from July 2019 to 30 September 2019.

Declaration of leviable sales

Levies are imposed under the *Agricultural and Veterinary Chemical Products Levy Imposition (General) Act 1994*, the *Agricultural and Veterinary Chemical Products Levy Imposition (Excise) Act 1994*, and the *Agricultural and Veterinary Chemical Products Levy Imposition (Customs) Act 1994*.

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For declarations issued September 2019, the due date of declarations is 31 October 2019. The due dates for payments of levies is 15 January 2020 and 15 June 2020.

Manufacturing Licencing Scheme

The Agvet Code requires all chemical products manufactured within Australia to be manufactured in licensed premises. Licence renewal notices have been sent with payment due by 30 August 2019.

APVMA Regulatory Update, 25 July 2019

<http://www.apvma.gov.au>

E-waste in Victoria

2019-08-16

The Victorian Government has banned e-waste from landfill in Victoria, effective 1 July 2019. E-waste is growing up to three times faster than general municipal waste in Australia. This ban helps to address the risks and opportunities associated with this rapid rate of growth. Electronic waste (e-waste) is defined as waste in the form of electrical or electronic equipment, devices or things (or materials or parts of such equipment, devices or things), the operation of which is dependent on, or designed for the generation, transfer or measurement of, an electric current or electromagnetic field. This means any device that has a plug, battery or power cord that is no longer working or wanted. It includes a range of items we use and discard from our homes and businesses, for example televisions, computers, mobile phones, kitchen appliances, whitegoods, rechargeable batteries and photovoltaic panels. E-waste must be separated from the storing, processing and disposal of other waste, as it can contain hazardous materials. These can harm human health and the environment. Also, valuable materials can be recovered for reuse from e-waste. Both e-waste and processed e-waste materials must be handled and stored with due care to avoid leakage and the release of hazardous substances into air, water or soil.

E-waste storage in Victoria

E-waste storage in Victoria has information about storing e-waste to avoid leakages and hazardous substances being released into the air, water or soil. This information is for businesses that store e-waste before it is transported to another facility for reprocessing. This includes local council transfer stations, resource recovery centres and other collection points for items like televisions, computers, mobile phones, batteries and lights.

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E-waste reprocessing in Victoria

E-waste reprocessing in Victoria has information about legal and licensing requirements for the reprocessing of e-waste.

This information is for businesses that reprocess e-waste as part of their operation

Further information on the new requirements is available:

- Waste Management Policy (E-waste)
- e-waste in Victoria (Department of Environment, Land, Water and Planning).

EPA Victoria, 27 June 2019

<http://www.epa.vic.gov.au/>

China Publishes Petrochemical Sector Carbon Emissions Norm

2019-08-16

On 30 July 2019, Standardisation Administration of China (SAC) publicly announced the schedule for development of "The Norm of Carbon Emission Caps per Unit Product of Petroleum and Chemical Industry" on the national public service platform for standards information. This public announcement precedes the actual drafting of the new standard which will not begin until the public announcement period ends on 13 August 2019. *The Norm of Carbon Emission Caps per Unit Product of Petroleum and Chemical Industry* will be drafted by several authorities including the China Petroleum and Chemical Industry Federation and China National Institute of Standardisation. The new standards aim to provide a scientific basis for government to implement carbon emission quotas and provide guidance for enterprises to reduce carbon emissions. This standard regulates the requirements, scope of statistics, calculation methods, and carbon emission management and measures for carbon emission caps, and is applicable to the calculation and evaluation of carbon emission caps for key products (refining, ethylene, urea, synthetic ammonia, methanol, soda ash, caustic soda, monoammonium phosphate, diammonium phosphate). This standard will also apply to newly established enterprise to manage carbon emission per unit product. Further information is available at: SAC

Chemlinked, 6 August 2019

<http://chemlinked.com/en/news>

The Victorian Government has banned e-waste from landfill in Victoria, effective 1 July 2019.

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Japan Announces 210 New Chemicals Substances under CSCL

2019-08-16

On 31 July 2019, the Japanese Ministry of Economy, Trade and Industry (METI), Ministry of the Environment (MOE), and Ministry of Health, Labor and Welfare (MHLW) released the Joint Notice No.2, announcing the names, serial numbers, and MITI numbers of 210 new chemical substances under the Chemical Substance Control Law (CSCL). Following the release, these substances will be considered as Newly Announced Chemical Substances (notified on and after 1 April 2011) and categorised as General Chemical Substances under the framework of CSCL. Japan has two systems for new chemical substance notification, one under the CSCL framework and the other subject to the Industrial Safety and Health Law (ISHL). Substances in the two notification systems are managed separately, which certainly overlap a lot. New chemical substances which have been registered as per the ISHL will be published four times each year (in March, June, September, and December, respectively); while those registered under the CSCL are published only once a year (usually in each July). Further information is available at: [Joint Notice No.2 of METI, MOE, and MHLW](#)

Chemlinked, 5 August 2019

<http://chemlinked.com/en/news>

AMERICA

EPA Takes Action to Provide Accurate Risk Information to Consumers, Stop False Labelling on Products

2019-08-16

The United States Environmental Protection Agency (EPA) is issuing guidance to registrants of glyphosate to ensure clarity on labelling of the chemical on their products. EPA will no longer approve product labels claiming glyphosate is known to cause cancer – a false claim that does not meet the labelling requirements of the *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA). The State of California's much criticised Proposition 65 has led to misleading labelling requirements for products, like glyphosate, because it misinforms the public about the risks they are facing. This action will ensure consumers have correct information, and is based on EPA's comprehensive evaluation of glyphosate. "It is irresponsible

The new standards aim to provide a scientific basis for government to implement carbon emission quotas and provide guidance for enterprises to reduce carbon emissions.

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to require labels on products that are inaccurate when EPA knows the product does not pose a cancer risk. We will not allow California's flawed program to dictate federal policy," said EPA Administrator Andrew Wheeler. "It is critical that federal regulatory agencies like EPA relay to consumers accurate, scientific based information about risks that pesticides may pose to them. EPA's notification to glyphosate registrants is an important step to ensuring the information shared with the public on a federal pesticide label is correct and not misleading." In April, EPA took the next step in the review process for glyphosate. EPA found – as it has before – that glyphosate is not a carcinogen, and there are no risks to public health when glyphosate is used in accordance with its current label. These scientific findings are consistent with the conclusions of science reviews by many other countries and other federal agencies. On 26 February 2018, the United States District Court for the Eastern District of California issued a preliminary injunction stopping California from enforcing the state warning requirements involving glyphosate's carcinogenicity, in part on the basis that the required warning statement is false or misleading. The preliminary injunction has not been appealed and remains in place. California's listing of glyphosate as a substance under Proposition 65 is based on the International Agency on the Research for Cancer (IARC) classifying it as "probably carcinogenic to humans." EPA's independent evaluation of available scientific data included a more extensive and relevant dataset than IARC considered during its evaluation of glyphosate, from which the agency concluded that glyphosate is "not likely to be carcinogenic to humans." EPA's cancer classification is consistent with many other international expert panels and regulatory authorities. Registrants with glyphosate products currently bearing Proposition 65 warning language should submit draft amended labelling that removes this language within 90 days of the date of the letter. For more information about EPA's comprehensive evaluation of glyphosate, visit <https://www.regulations.gov/document?D=EPA-HQ-OPP-2009-0361-0073>.

The United States Environmental Protection Agency (EPA) is issuing guidance to registrants of glyphosate to ensure clarity on labelling of the chemical on their products.

U.S EPA, 8 August 2019

<http://www.epa.gov>

EPA Announces Biofuel and Small Refinery Exemption Priorities

2019-08-16

The United States Environmental Protection Agency (EPA) is set to announce its final decisions related to 31 small refinery exemptions and 6 application denials. Under EPA's Renewable Fuel Standard (RFS)

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program, a small refinery may be granted a temporary exemption from its annual Renewable Volume Obligations (RVOs) if it can demonstrate that compliance with the RVOs would cause the refinery to suffer disproportionate economic hardship. EPA evaluates submissions to determine whether an exemption may be granted, based on information presented by the petitioning refinery and on the statutory and regulatory requirements for exemption. EPA is proud to announce its intention to further explore opportunities to remove regulatory burdens that prevent marketplace entrance and growth to natural gas, flexible fuel vehicles, and E85 fuels. EPA welcomes the opportunity to engage with stakeholders to explore deregulatory options in the coming months to ensure that it plays its part in supporting American farmers and consumers. Finally, EPA has also been in regular communication with the National Corn Growers Association and their state affiliates on the agency's intent to expedite the reregistration of atrazine, a critical crop protection tool for corn. EPA is committed to an expeditious and transparent process to ensure that America's corn growers have the tools they need to grow safe, healthy, and abundant food for all Americans and a growing global population. EPA's letter on atrazine is available [here](#).

U.S EPA, 9 August 2019

<http://www.epa.gov>

ACGIH® Will Not Proceed with TLV® for Carbon Nanotubes in 2020

2019-08-16

The American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values for Chemical Substances (TLV®-CS) Committee has included carbon nanotubes on its 2019 list of chemical substances and other issues under study. Being placed on the under study list indicated that the TLV®-CS Committee had selected carbon nanotubes for development of a threshold limit value (TLV®). On 30 July 2019, ACGIH® [announced](#) the release of its [two-tier under study list](#). Tier 1 lists the chemical substances and physical agents that may move forward as a notice of intended change (NIC) or notice of intent to establish (NIE) in the upcoming year, based on their status in the development process. Tier 2 consists of those chemical substances and physical agents that will not move forward, but will either remain on or be removed from the under study list for the next year. Carbon nanotubes are included in Tier 2. If

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carbon nanotubes are included on the 2020 under study list, stakeholders will have an opportunity to submit substantive data and comments.

National Law Review, 7 August 2019

<http://www.natlawreview.com>

Trump administration reauthorizes use of “cyanide bombs” to kill wild animals

2019-08-16

The United States Environmental Protection Agency has recently reauthorized the use of controversial chemical traps to kill coyotes, dogs, foxes and other wild animals across the U.S. These “cyanide bombs” are meant to protect livestock although some environmental groups are calling for a nationwide ban and saying they are inhumane. According to a recent interim decision, EPA officials approved the use of M-44 devices, which trap wildlife with bait before releasing sodium cyanide into their mouths, killing them. The devices “inhumanely and indiscriminately killing thousands of animals every year,” the Centre for Biological Diversity said in a statement. “They have also injured people.” Wildlife Services, the division of the U.S. Department of Agriculture responsible for wildlife management, is authorized to use the devices, as are state agencies in South Dakota, Montana, Wyoming, New Mexico and Texas. Wildlife Services kills large numbers of wild animals every year on behalf of farmers and ranchers. At the end of 2018, the EPA proposed the renewed use of sodium cyanide, allowing time for public comment until March. More than 99.9 percent of comments urged the EPA to ban M-44s, according to an analysis by the Centre for Biological Diversity and Western Environmental Law Centre. “The overwhelming majority of comments from the general public, including the more than 20,000 letters from the write-in campaign, did not support the continued registration of sodium cyanide predecide uses (M-44 devices),” the EPA wrote in its proposal. Opponents sited the dangers to residential areas and ecological concerns. Instead of discontinuing the use of the devices, the EPA has updated its rules to include some restrictions with the hope of reducing accidents. For example, the devices cannot be placed within 100 feet of a public road or pathway, increased from 50 feet, and elevated warning signs must be placed within 15 feet of each device, decreased from 25 feet. Perhaps most pertinent, people living within a half-mile of an M-44 placement must be notified. In 2018, a family in Idaho sued the government for more than \$150,000 after a cyanide trap near their home injured their son and killed their dog the previous year, bringing national attention

The American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values for Chemical Substances (TLV®-CS) Committee has included carbon nanotubes on its 2019 list of chemical substances and other issues under study.

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to the issue. According to the family, no one with the government told them the poisonous device was near their backyard. The government rejected the claims and asked for the lawsuit to be dismissed, claiming the family's negligence led to the incident. "Cyanide traps can't be used safely by anyone, anywhere," said Collette Adkins, carnivore conservation director at the Centre for Biological Diversity. "While the EPA added some restrictions, these deadly devices have caused too much harm to remain in use. We need a permanent nationwide ban to protect people, pets and imperiled wildlife from this poison." According to Wildlife Services' data, M-44s killed 6,579 animals in 2018. More than 200 deaths were nontarget animals, including foxes, opossums, raccoons, skunks and a bear. "In my 25 years working with M-44 victims I've learned that Wildlife Services' agents frequently do not follow the use restrictions," said Brooks Fahy, executive director of Predator Defence. "And warning signs will not prevent more dogs, wild animals and potentially children from being killed. They cannot read them. M-44s are a safety menace and must be banned."

CBS News, 8 August 2019

<http://www.cbc.ca>

EUROPE

Public consultation: chlorinated paraffins in food and feed

2019-08-16

The European Food Safety Authority (EFSA) is seeking feedback from interested parties on its scientific opinion about the risks to human and animal health related to the presence of chlorinated paraffins in food and feed. Chlorinated paraffins have been produced since the 1930s for a variety of purposes and are used as additives in lubricants, flame retardants in the rubber industry, and in plastics and sealants, among other uses. Chlorinated paraffins may be released into the environment through product use or improper disposal and therefore may also contaminate food and feed. The deadline for submitting comments is 17 September 2019. Further information is available at: [Public consultation on the draft EFSA opinion on Chlorinated Paraffins in feed and food](#)

EFSA, 6 August 2019

<http://www.efsa.europa.eu>

The United States Environmental Protection Agency has recently reauthorised the use of controversial chemical traps to kill coyotes, dogs, foxes and other wild animals across the U.S.

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Safe Recovery and Disposal of Wastes containing Nanomaterials

2019-08-16

The German chemical industry is committed to a responsible production and use of nanomaterials. To support member companies, and customer companies in the value chain, to manage the health, safety and environmental aspects of nanomaterials throughout the life cycle, the German Chemical Industry Association VCI has issued a series of documents. They provide guidance on all aspects of a good product stewardship on nanomaterials. This includes, i.a., the safe recovery and disposal of wastes containing nanomaterials. Wastes containing nanomaterials can be generated in the production or use of nanomaterials. Such wastes occur e.g. in the production of substances, mixtures or products, in the processing and repair of products, or in the disposal of products at the end of their lifecycle. Further information is available at: www.vci.de

Chemycal, 12 August 2019

<http://chemycal.com>

European Commission's public consultation on postponing harmonised rules for poison centres notification

2019-08-16

The European Commission has launched a public consultation on postponing the compliance date to submit information on hazardous chemical mixtures for consumer use. Companies have to notify the national poison centres to facilitate adequate emergency health response. The draft regulation proposes to postpone the first compliance date from 1 January 2020 to 1 January 2021. The deadline of the public consultation is 18 August 2019. The European Chemicals Agency (ECHA) will update its webpages and other material accordingly once the formal decision has been made. Further information is available at: poisoncentres.echa.europa.eu

Chemycal, 7 August 2019

<http://chemycal.com>

The European Food Safety Authority (EFSA) is seeking feedback from interested parties on its scientific opinion about the risks to human and animal health related to the presence of chlorinated paraffins in food and feed.

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ANSES to initiate a call for tenders to examine the carcinogenic potential of glyphosate

2019-08-16

In an opinion, ANSES has drafted specifications for further studies on the carcinogenic potential of glyphosate. The associated call for tenders is to be issued in the coming days. This research will investigate glyphosate's possible carcinogenic mechanisms of action and assess their relevance for humans. Glyphosate is an active substance used in many herbicides. In December 2017, the European Union re-approved its use for a further five years. As part of the national Glyphosate withdrawal plan designed to phase out its main uses by the end of 2020, ANSES is carrying out a series of studies on this active substance and the products containing it. Following the controversy on the carcinogenic classification of glyphosate, ANSES was asked to draw up specifications for one or more toxicology studies in order to improve knowledge of the substance's carcinogenic potential. Further information is available at: www.anses.fr

Chemycal, 6 August 2019

<http://chemycal.com>

Nordic Council of Ministers Publishes Report on Applicability of GHS Classification Criteria to Nanomaterials

2019-08-16

In May 2019, the Nordic Council of Ministers published a working paper entitled: The applicability of the GHS classification criteria to nanomaterials. The goal of the project was to review the applicability of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) to manufactured nanomaterials, taking into account the progress of international scientific work. The report notes that the Organisation for Economic Cooperation and Development (OECD) Working Party on Manufactured Nanomaterials (WPMN) has generated and compiled much data on nanomaterials under the Testing Program of Manufactured Nanomaterials. These data were further assessed for some pre-selected nanomaterials: single-walled carbon nanotubes (SWCNT), nano silicon dioxide, nano silver, and nano zinc oxide. Additionally, the appropriateness of the GHS classification criteria for the generated data were evaluated for five health hazard classes for which an initial screening had shown a need for classification. Finally, if applicable, relevant classifications of the nanomaterials were assessed. For each of the

The European Commission has launched a public consultation on postponing the compliance date to submit information on hazardous chemical mixtures for consumer use.

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relevant hazard classes, the available test data of the nanomaterials were summarised and evaluated with respect to:

- Applicability of the test methods;
- Applicability of the GHS criteria and proposed classification;
- Identified data gaps and uncertainties; and
- Need for revision of GHS criteria or further guidance.

The report lists the following overall observations and reflections:

- In general, the current GHS classification criteria for the five evaluated hazard classes were found to be applicable to the generated data on SWCNT, nano silicon dioxide, nano silver, and nano zinc oxide.
- Differences in toxicity exist between the various types/qualities (g., related to production methods (e.g., silicon dioxide) or impurity profile (e.g., SWCNT)) of the same nanomaterials that may result in different classifications of the various types/qualities.
- Specific target organ toxicity – repeat exposure (STOT RE) is considered a highly relevant hazard class to examine for all the nanomaterials especially considering the lung as the target organ.
- For voluminous nanomaterials (e., nanomaterials with a relatively high specific surface area and low density), testing at high dose levels may not be technically achievable. Hence, testing in accordance with OECD Test Guideline (TG) methods covering all relevant dose levels for acute toxicity classification and STOT RE classification according to the GHS criteria values may not be possible. This is especially relevant for testing via inhalation route.
- For acute toxicity and STOT RE, the GHS criteria based on a mass-based dose metric can be applied for voluminous nanomaterials, however, the dose levels corresponding to the less severe hazard categories cannot be technically achieved. It may be examined whether another dose metric (g., specific surface area or particle number concentrations) would be a better metric for enabling differentiation in toxicity and the classification of nanomaterials.
- It is noted that most testing regarding repeated inhalation exposure has focused on identification of no observed adverse effect concentration (NOAEC)/lowest observed adverse effect concentration (LOAEC) levels and the examination of early signs of toxicity (g., various inflammatory markers) rather than establishing data for STOT RE classification. So mostly very low exposure levels compared to the STOT RE criteria have been used. Thus, there are data gaps for assessing the proper STOT RE classification of nanomaterials.

In May 2019, the Nordic Council of Ministers published a working paper entitled: The applicability of the GHS classification criteria to nanomaterials.

Regulatory Update

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- As support for a STOT RE classification, it should be considered how to use an adverse outcome pathway (AOP) or mode of action (MOA) approach using inflammatory signs/markers or mild/moderate histopathological effects induced in target organs at very low exposure levels for classification purpose.
- Also, it may be examined how and under which circumstances data from intratracheal instillation or pharyngeal aspiration may be used as support for STOT RE classification if data from inhalation testing are limited or do not cover the relevant dose ranges for classification.

Nano & Other Emerging Technologies Blog, 2 August 2019

<http://nanotech.lawbc.com>

Bulletin Board

AUG. 23, 2019

Regulatory Update

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Public consultations on applications for authorisation

2019-08-15

The European Chemicals Agency (ECHA) is seeking comments on 27 applications for authorisation covering 39 uses. The following applications are proposed:

- Chromium trioxide (EC 215-607-8, CAS 1333-82-0) used in the manufacture of electrolytic chromium/chromium oxide coated steel (ECCS);
- 4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated and 4-Nonylphenol, branched and linear, ethoxylated (EC-, CAS-) used in the production of various medical devices (e.g. *in vitro* diagnostic kits) and medicinal products (e.g. active pharmaceutical ingredients); used in the production of chromatography resins for the biopharmaceutical industry, food and beverage sector, and academia;
- Pitch, coal tar, high-temp. (EC 266-028-2, CAS 65996-93-2) and Anthracene oil (EC 292-602-7, CAS 90640-80-5) used in the manufacture of formulations mixtures for various industrial uses; and
- Pitch, coal tar, high-temp. (EC 266-028-2, CAS 65996-93-2) used as a binder in the manufacture of clay targets.

More information about the uses that authorisation is applied for, including the description of the function of the substance, exposure scenarios, possible alternatives identified by the applicants, together with socio-economic information, is available on ECHA's website. The deadline for comments is 9 October 2019. To provide feedback go to: [Give comments](#)

ECHA News, 14 August 2019

<http://echa.europa.eu>

Public consultation on harmonised classification and labelling

2019-08-15

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

- 2,2-bis(acryloyloxymethyl)butyl acrylate trimethylolpropane triacrylate (EC 239-701-3, CAS 15625-89-5);
- Benzophenone (EC 204-337-6, CAS 119-61-9);
- Fluopicolide (EC 607-285-6, CAS 239110-15-7);

The European Chemicals Agency (ECHA) is seeking comments on 27 applications for authorisation covering 39 uses.

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- 4,4'-oxydi(benzenesulphonohydrazide) (EC 201-286-1, CAS 80-51-3); and
- Toluene-4-sulphonohydrazide (EC 216-407-3, CAS 1576-35-8).

The deadline for comments is 11 October 2019. To provide feedback, go to: [Give comments](#)

ECHA News, 14 August 2019

<http://echa.europa.eu>

Restriction report for calcium cyanamide available

2019-08-15

The European Chemicals Agency (ECHA) has pre-published the proposal to restrict calcium cyanamide (EC 205-861-8, CAS 156-62-7). The public consultation will be launched - together with the formal proposal - once ECHA's scientific committees for Risk Assessment (RAC) and Socio-economic Analysis (SEAC) agree on the conformity of the report. Further information is available at:

- [Registry of restriction intentions](#)
- [Completed activities on restrictions](#)

ECHA News, 14 August 2019

<http://echa.europa.eu>

Court judgment on the identification of Bisphenol A as an SVHC

2019-08-15

On 11 July 2019, the General Court issued a judgment in case T-185/17 dismissing in its entirety an action brought by PlasticsEurope. This action was seeking the annulment of the European Chemicals Agency's (ECHA) decision to include Bisphenol A (BPA; EC 201-245-8, CAS 80-05-7) in the Candidate List on the basis of its classification as toxic for reproduction category 1B. In particular, the General Court confirmed that ECHA can include a substance in the Candidate List even if it has intermediate uses. Furthermore, the Court considered that:

The inclusion in the Candidate List of a substance classified as toxic for reproduction category 1B is carried out solely on account of the intrinsic properties of that substance and not on account of its uses.

The European Chemicals Agency (ECHA) has pre-published the proposal to restrict calcium cyanamide (EC 205-861-8, CAS 156-62-7).

REACH Update

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When including a substance in the Candidate List, ECHA is not required to add a statement about the impact of that inclusion on any intermediate use of that substance.

Further information is available at:

- [General Court's press release](#)
- [Case T-185/17](#)

ECHA News, 14 August 2019

<http://echa.europa.eu>

PACT updated with 1 finalised RMOA

2019-08-15

On 12 August 2019, ECHA's Public Activities Coordination Tool (PACT) was updated with the following finalised RMOA:

- 1,1'-oxybis(2,4-dibromobenzene)

This update brought the number of PACT RMOA and hazard assessment substances to 472.

Yorda's Hive, 12 August 2019

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

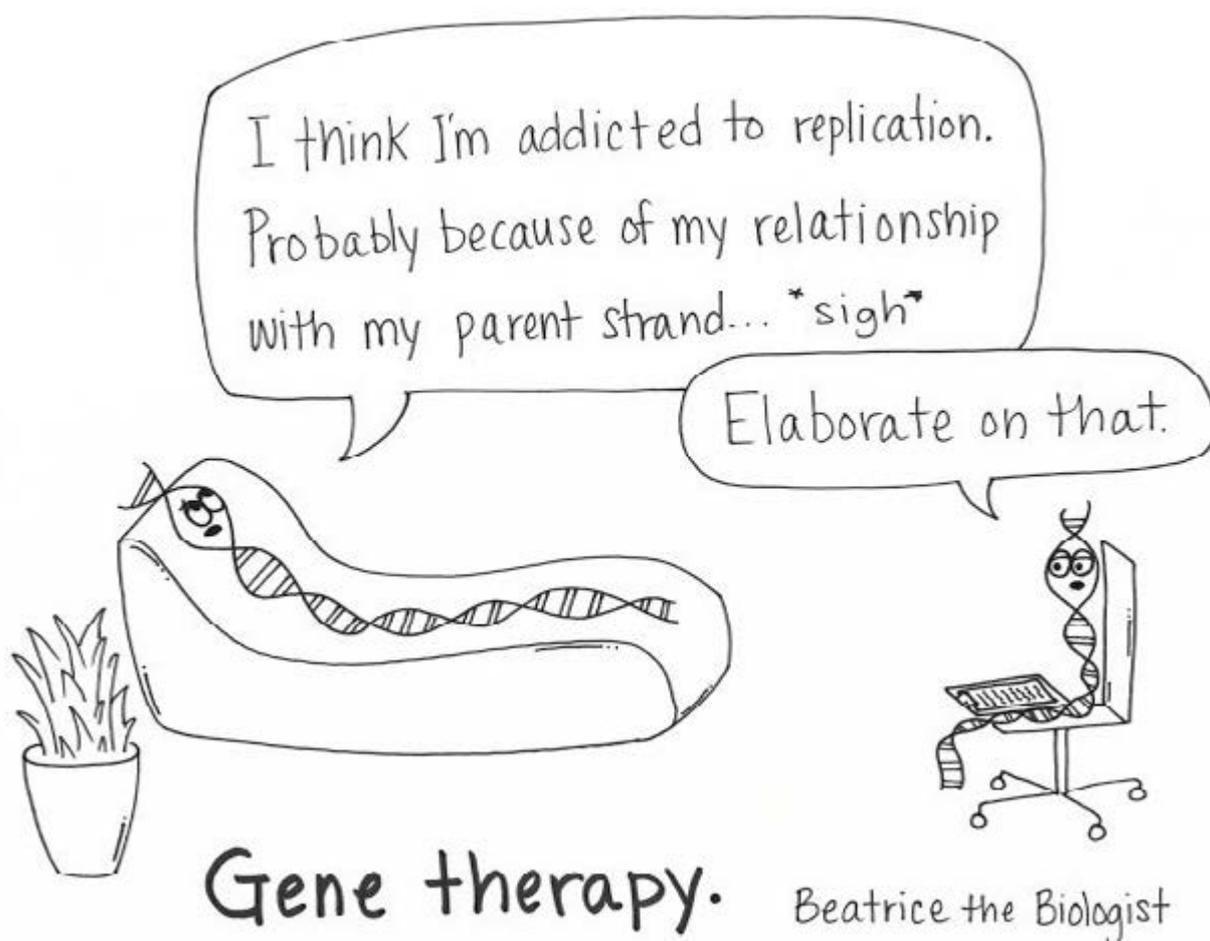
**On 12 August 2019,
ECHA's Public Activities
Coordination Tool
(PACT) was updated**

Janet's Corner

CHEMWATCH

Gene Therapy

2019-08-13



Hazard Alert

CHEMWATCH

Dibenzofuran

2019-08-05

Dibenzofuran is a heterocyclic organic compound with the molecular formula $C_{12}H_8O$. It is an aromatic compound that has two benzene rings fused to a central furan ring. All the numbered carbon atoms have a hydrogen atom bonded to each of them. It is a volatile white solid that is soluble in non-polar organic solvents. [1] Dibenzofuran is created from the production of coal tar. [2]

USES [2]

Dibenzofuran is used as an insecticide and to make other chemicals.

SOURCES AND ROUTES OF EXPOSURE

Sources of Exposure [3,4]

- Dibenzofuran has been detected in emissions from combustion of coal, biomass, refuse, diesel fuel, and tobacco.
- It is also found in leachates from commercial coal tar and is formed from the incomplete combustion of propane.
- Dibenzofuran also is a photolytic product of environmental photolysis of chlorinated biphenyl ethers in surface waters by sunlight.
- The primary stationary sources that have reported emissions of dibenzofuran in California are lumber and wood products manufacturers, and manufacture of fabricated metal ordnance and accessories.
- It may be found in coke dust, grate ash, fly ash, and flame soot.

Routes of Exposure [3,4]

- Occupational exposure may occur through inhalation and dermal contact, particularly at sites engaged in combustion/carbonisation processes, such as coal tar and coal gasification operations.
- Dibenzofuran is released to the ambient air from combustion sources. The general public may be exposed to dibenzofuran through the inhalation of contaminated air or through the consumption of contaminated drinking water or food.
- Since it has been found in tobacco smoke, you can be exposed if you smoke cigarettes or breathe cigarette smoke.

Hazard Alert

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HEALTH EFFECTS [5]

Acute health Effects

- Dibenzofuran causes skin irritation.
- Exposure to dibenzofuran can irritate the eyes, nose and throat.

Chronic Health Effects

Repeated contact with Dibenzofuran can cause:

- Skin growths;
- Rashes (may be made worse by exposure to sunlight); and
- Changes in skin colour.

Cancer Hazard

Dibenzofuran has not been tested for its ability to cause cancer in animals. The U.S. Environmental Protection Agency has determined that there is not enough information available to classify dibenzofuran as a cancer causing substance.

Reproductive Hazard

Dibenzofuran has not been tested for its ability to affect reproduction.

SAFETY [6]

First Aid Measures

- Inhalation: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
- Skin Contact: Wash off with soap and plenty of water. Consult a physician.
- Eye Contact: Flush eyes with water as a precaution.
- Ingestion: Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Exposure Controls and Personal Protection

Engineering Controls

- Ensure there are appropriate engineering controls in place.
- Handle in accordance with good industrial hygiene and safety practice.
- Wash hands before breaks and at the end of workday.

Hazard Alert

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Personal Protective Equipment

The following personal protective equipment is recommended when handling dibenzofuran:

Eye/face Protection:

- Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin Protection:

- Handle with gloves.
- Gloves must be inspected prior to use.
- Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product.
- Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices.
- Wash and dry hands.
- The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.
- Full contact Material: Nitrile rubber

Body Protection:

- Complete suit protecting against chemicals.
- The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory Protection:

- For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.
- For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges.
- Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

REGULATION

United States [5]

No occupational exposure limits have been established by dibenzofuran.

Hazard Alert

CHEMWATCH

Australia

No occupational exposure limits have been established by dibenzofuran.

REFERENCES

1. <http://en.wikipedia.org/wiki/Dibenzofuran>
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3. <http://scorecard.goodguide.com/chemical-profiles/html/dibenzofuran.html>
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Gossip

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Freezing cells made safer thanks to new polymer

2019-08-07

Cell freezing (cryopreservation) -- which is essential in cell transfusions as well as basic biomedical research -- can be dramatically improved using a new polymeric cryoprotectant, discovered at the University of Warwick, which reduces the amount of 'anti-freeze' needed to protect cells. The ability to freeze and store cells for cell-based therapies and research has taken a step forward in the paper 'A synthetically scalable poly(ampholyte) which dramatically Enhances Cellular Cryopreservation.' published by the University of Warwick's Department of Chemistry and Medical School in the journal *Biomacromolecules*. The new polymer material protects the cells during freezing, leading to more cells being recovered and less solvent-based antifreeze being required. Cryopreservation of cells is an essential process, enabling banking and distribution of cells, which would otherwise degrade. The current methods rely on adding traditional 'antifreezes' to the cells to protect them from the cold stress, but not all the cells are recovered and it is desirable to lower the amount of solvent added. The new Warwick material was shown to allow cryopreservation using less solvent. In particular, the material was very potent at protecting cell monolayers -- cells which are attached to a surface, which is the format of how they are grown and used in most biomedical research. Having more, and better-quality cells, is crucial not just for their use in medicine, but to improve the quality and accessibility of cells for the discovery of new drugs for example. Cell-based therapies are emerging as the "fourth pillar" of chemo-therapy. New methods to help distribute and bank these cells will help make them more accessible and speed up their roll-out, and this new material may aid this process. Professor Matthew Gibson who holds a joint appointment between the Department of Chemistry and Warwick Medical School comments: "Cryopreservation is fundamental to so much modern bioscience and medicine, but we urgently need better methods to meet the needs of advanced cell-based therapies. Our new material is easy to scale up, which is essential if this is to be widely used, and we found it to be very protective for several cell lines. The simplicity of our approach will hopefully help us translate this to real applications quickly, and make an impact in healthcare and basic research."

Cell freezing (cryo-preservation) can be dramatically improved using a new polymeric cryoprotectant which reduces the amount of 'anti-freeze' needed to protect cells.

Science Alert, 29 July 2019

<http://www.sciencealert.com.au>

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3D printed pill samples gut microbiome to aid diagnosis and treatment

2019-08-07

A research team led by Tufts University engineers has developed a 3D printed pill that samples bacteria found in the gut -- known as the microbiome -- as it passes through the gastrointestinal tract (GI). The ability to profile bacterial species inhabiting the gut could have important implications for the diagnosis and treatment of conditions that are affected by the microbiome, according to the researchers. The 3D printed pill described in the journal *Advanced Intelligent Systems* represents the first non-invasive diagnostic tool capable of providing a profile of microbiome populations throughout the entire GI tract, according to the researchers. Current methods of sampling the microbiome involve analysis of faecal DNA and metabolites, but that approach provides little information of the environment upstream of the distal colon, where bacterial species can vary significantly. The pill has been studied and found to provide accurate identification of bacterial populations and their relative abundance in both in vitro and in vivo applications, the paper says. It has been tested in pigs and primates, yet clinical trials will be needed to determine if the pill can be used routinely in humans for clinical care. More than 1,000 species of bacteria can inhabit the gut. The vast majority of these bacteria have a beneficial, supportive role in digestion and protection against disease. When the natural balance of the microbiome is skewed, a condition called "dysbiosis" occurs, which can be associated with inflammation, susceptibility to infections, and even the exacerbation of other diseases such as cancer. Research is increasingly unveiling specific microbiome metabolites that have beneficial or protective effects for the host against disease. "We are learning quite a lot about the role of gut microbiome in health and disease. However, we know very little about its biogeography," said Sameer Sonkusale, professor of electrical and computer engineering at Tufts University's School of Engineering and corresponding author of the study. "The pill will improve our understanding of the role of spatial distribution in the microbiome profile to advance novel treatments and therapies for a number of diseases and conditions." The pill is more sophisticated than just a sponge. It is manufactured in a 3D printer with microfluidic channels that can sample different stages of the GI tract. The surface of the pill is covered with a pH sensitive coating, so that it does not absorb any samples until it enters the small intestine (by-passing the stomach) where the coating dissolves. A semi-permeable membrane separates two chambers in the pill -- one containing helical channels that take up the bacteria and the

A research team led by engineers has developed a 3D printed pill that samples bacteria found in the gut

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other containing a calcium salt-filled chamber. The salt chamber helps create an osmotic flow across the membrane which pulls the bacteria into the helical channels. A small magnet in the pill enables one to hold it at certain locations in the gut for more spatially targeted sampling using a magnet outside the body. A fluorescent dye in the salt chamber helps locate the pill after it exits the GI tract. "The design of this device makes it incredibly easy to use, posing little risk to the subject being measured, yet providing so much information," said Giovanni Widmer, professor of infectious diseases and global health in Tufts Cummings School of Veterinary Medicine, and co-author of the study responsible for exploring the pills effectiveness in animal studies. "Compared to other non-invasive diagnostic devices, this is like having an EKG for gut health." The researchers see this technology as bridging an important gap in gastrointestinal diagnosis. "We have incredible technology to analyse bacterial populations using DNA sequencing techniques, but until now have not had a way to sample bacteria throughout the GI tract in a way that was not invasive," said Hojatollah Rezaei Nejad, a post-doctoral fellow studying novel applications of 3D printing in Sonkusale's laboratory at Tufts and lead author of the study. "By sampling non-invasively, this pill could help us better identify and understand the role of different bacterial species in health and disease."

Science Daily, 25 July 2019

<http://www.sciencealert.com.au>

Performing chemistry in floating droplets

2019-08-07

Could chemists be ready to ditch the venerable test tube, the very symbol of chemistry in the minds of many people? Maybe not quite yet, but Caltech's Jack Beauchamp is working on it. Beauchamp is doing work in what he calls "lab-in-a-drop" chemistry, in which chemical reactions are performed within a drop of liquid suspended in midair through acoustic levitation. Acoustic levitation works by creating areas of high and low pressure in the air through the use of ultrasonic transducers. These transducers act like tiny but powerful speakers that operate at a frequency above what human ears can hear. The sonic energy emitted by these transducers is focused in such a way that the high- and low-pressure zones they create form "traps" that can hold small objects in place in the air. An object placed in one of the low-pressure zones is held there by the high-pressure zones that surround it. An acoustic levitator of this sort can be constructed for about \$75 from off-the-shelf parts using 3-D-printing

Could chemists be ready to ditch the venerable test tube, the very symbol of chemistry in the minds of many people? Maybe not quite yet, but Caltech's Jack Beauchamp is working on it.

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techniques. In a new paper, Beauchamp and his colleagues describe the use of the technique to study how a skin-cancer drug works at a chemical level. The research, he says, represents the first successful use of acoustic levitation as a “wall-less” reactor in a detailed study of chemical reactions. In the work, Beauchamp and his team coated a droplet of water with lipids, biomolecules that make up cell membranes. They then applied an anti-cancer drug to the droplet and used a mass spectrometer to “sniff” the chemical signature given off by the droplet as the drug reacted with the lipid when illuminated with a red laser pointer. In the experiment, the researchers added a small amount of one of two lipids, cardiolipin and POPG (1-palmitoyl-2-oleoyl-sn-glycero-3-phospho-(1'-rac-glycerol)), to each drop of water. The lipids migrated to the surface of the droplet, where they organised to form a thin film that is similar in composition to the cell membrane of a living cell. With the membrane established, a chemical called temoporfin was added to the droplet. Temoporfin, a ring-like molecule, is excited by red light. In this state, the temoporfin transfers energy to molecular oxygen, forming an excited electronic state that easily oxidises molecules it comes into contact with, including those that make up cell membranes. This makes temoporfin useful as a treatment for some skin cancers. A doctor could apply the drug to a cancerous lesion and then illuminate it with red light, which easily shines through tissues. As the compound is illuminated and excited, it oxidises vital cellular materials, including lipids, proteins, and nucleic acids, triggering cell death. It was this cancer-killing process that Beauchamp wanted to study. “When you’re doing this chemistry, you’d like to be able to carry out these reactions under conditions where you don’t have any contact of the liquid with surfaces,” he says. “We achieve this goal by performing chemistry in a levitated droplet.” The acoustic levitator allowed Beauchamp and his team to suspend in midair a 1-millimetre droplet of water containing a mixture of the lipid and temoporfin. The droplet was then illuminated by red laser light, exciting the temoporfin and causing it to oxidise the molecules of the membrane layer. As this oxidation was occurring, a pair of high-voltage electrodes placed near the droplet pulled minute amounts of material off the droplet and into the sensor of a mass spectrometer, which provided readings that allowed researchers to deduce the molecular structures of compounds within the drop. By continually monitoring these readings, the researchers were able to see how the compounds on the surface became progressively more oxidised. By looking at these reaction products, Beauchamp says the research team could determine how the oxidation processes work. “As far as I know, we’re the only people doing serious chemistry this way, examining the kinetics and mechanism of the reactions involved” Beauchamp says. Acoustic levitation could find

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use in other fields as well, he says. As an example, he cites the research of Caltech's Joe Parker, an assistant professor of biology and biological engineering who studies the symbiotic relationship between certain species of ants and beetles. Beauchamp says it would be possible to levitate an ant and a beetle in close proximity to one another and then use the apparatus to analyse the pheromones they emit. The technique could have other applications as well. In collaborative studies with Caltech's John Seinfeld, Louis E. Nohl Professor of Chemical Engineering, Beauchamp previously revealed details of the complex environmental chemistry that leads to the formation of organic aerosols in the atmosphere in studies using droplets hanging on the end of a capillary. With the new levitation methodology, that capillary would no longer be required. The paper describing Beauchamp's research, titled "Mass Spectrometric Study of Acoustically Levitated Droplets Illuminates Molecular-Level Mechanism of Photodynamic Therapy for Cancer Involving Lipid Oxidation," appears in the April 23 issue of *Angewandte Chemie*.

Phys.org, 29 July 2019

<http://phys.org>

Scientists discover approach to activate inert gases

2019-08-07

Inert gases like argon typically do not form chemical bonds except under extreme conditions, such as the icy cold of outer space. As shared in the Proceedings of the National Academy of Sciences, an international team of scientists has developed a ground-breaking approach to design and generate gaseous ions that bind even argon at room temperature. This surprising innovation creates opportunities to activate inert compounds and elements and use them in new ways. Scientists relied on positively charged ions when trying to bind argon in the past. They deemed these ions "electrophiles" because of an affinity for sharing electrons. The new approach introduces an apparently counterintuitive idea. Special negatively charged ions can act as super-electrophiles. This unique way of looking at binding opens the door to fundamentally new opportunities. Scientists from Germany's University of Leipzig, University of Wuppertal, and University of Bremen joined with colleagues at the University of the Free State in South Africa, University of Washington, Purdue University, Pacific Northwest National Laboratory, and EMSL, the Environmental Molecular Sciences Laboratory, to answer a puzzling question. Under what well-defined circumstances could negatively-charged ions be made reactive enough to bind with argon? They theorised that a scaffolding of

An international team of scientists has developed a ground-breaking approach to design and generate gaseous ions that bind even argon at room temperature.

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negatively charged atoms around a strong positively charged centre could be exceptionally reactive and show different binding properties than a highly reactive positively charged ion alone. To validate the concept, they synthesised the most stable doubly negatively charged molecule ever investigated. Refining it further proved that a negatively charged fragment of it could spontaneously bind with argon at room temperature. Using EMSL's Low Temperature Photoelectron Spectroscopy equipment coupled with high-level computational studies, they characterized this molecule as highly reactive and structurally stable. The work could lead to activation of other inert compounds and elements.

Phys.org, 26 July 2019

<http://phys.org>

A good first step toward nontoxic solar cells

2019-08-07

Solar panel installations are on the rise in the U.S., with more than 2 million new installations in early 2019, the most ever recorded in a first quarter, according to a recent report by Solar Energy Industries Association and Wood Mackenzie Power & Renewables. To meet the ever-increasing demands, low-cost and more efficient alternatives to silicon-based solar cells -- currently the most widely used technology -- are desirable. In the past decade, lead-halide perovskites have surged as the most promising class of alternative materials; however, they are unstable. They contain lead, which is toxic and poses potential health and environmental hazards such as groundwater contamination. A team of engineers at Washington University in St. Louis has found what they believe is a more stable, less toxic semiconductor for solar applications using a novel double perovskite oxide discovered through data analytics and quantum-mechanical calculations. Their work was published online 11 June in *Chemistry of Materials*. Rohan Mishra, assistant professor of mechanical engineering & materials science in the McKelvey School of Engineering, led an interdisciplinary, international team that discovered the new semiconductor, made up of potassium, barium, tellurium, bismuth and oxygen (KBaTeBiO₆). The lead-free double perovskite oxide was one of an initial 30,000 potential bismuth-based oxides. Of those 30,000, only about 25 were known compounds. Using materials informatics and quantum mechanical calculations on one of the fastest supercomputers in the world, Arashdeep Singh Thind, a doctoral student in Mishra's lab based at Oak Ridge National Laboratory, found KBaTeBiO₆ to be the most promising out of the 30,000 potential oxides. "We found that this looked to

Engineers discover lead-free perovskite semiconductor for solar cells using data analytics, supercomputers

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be the most stable compound and that it could be synthesized in the lab," Mishra said. "More importantly, whereas most oxides tend to have a large band, we predicted the new compound to have a lower band gap, which is close to the halide perovskites, and to have reasonably good properties." The band gap is the energy barrier that electrons must overcome to form free carriers that, in the context of a solar cell, can be extracted to power an electrical device or stored in a battery for later use. The energy to overcome this barrier is provided by sunlight. The most promising compounds for solar cell applications have a band gap of about 1.5 eV, or electronvolt, Mishra said. Mishra discussed the possibility of synthesising KBaTeBiO_6 with Pratim Biswas, assistant vice chancellor, the Lucy & Stanley Lopata Professor and chair of the Department of Energy, Environmental & Chemical Engineering. Shaline Kavadiya, then a McKelvey Engineering doctoral student and now a postdoctoral research associate at Arizona State University, got to work on perfecting the recipe. "Shaline spent about six months synthesising the material," Mishra said. "Once she was able to synthesise it, as we had predicted, it was stable and had a band gap of 1.88 eV, which we also predicted." Mishra said these are first-generation solar cells that need more fine tuning of the band gap, but it is a good first step toward non-toxic solar cells. "This shows that we can go away from these lead-halide perovskites," Mishra said. "This opens up a really big space for designing semiconductors not just for solar cell applications but also for other semiconductor applications, such as LCD displays." Next, the team will study the role of any defects in this new semiconductor and look to more advanced synthesis techniques, including using aerosol techniques.

EurekAlert, 26 July 2019

<http://www.eurekalert.org>

A super-thin slice of wood can be used to turn saltwater drinkable

2019-08-07

In membrane distillation, salty water is pumped through a film, usually made of some sort of polymer with very narrow pores that filter out the salt and allow only water molecules through. Jason Ren at Princeton University in New Jersey and his colleagues developed a new kind of membrane made of natural wood instead of plastic. "If you think of traditional water filtration, you need very high-pressure pumping to squeeze the water through, so it uses a lot of energy," says Ren. "This is more energy efficient and it doesn't use fossil-fuel based materials like

Filtering the salt from seawater can take a lot of energy or specialised engineering. A thin membrane made of porous wood may be able to fix that.

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many other membranes for water filtration." His team's membrane is made of a thin piece of American basswood, which undergoes a chemical treatment to strip away extra fibres in the wood and to make its surface slippery to water molecules. One side of the membrane is heated so that when water flows over that side it is vaporised. The water vapour then travels through the pores in the membrane toward its colder side and leaves the salt behind, condensing as fresh, cool water. This takes far less energy than simply boiling all of the saltwater because there's no need to maintain a high temperature for more than a thin layer of water at a time, Ren says. This method filters about 20 kilograms of water per square metre of membrane per hour, which is not quite as quick as polymer membranes. The researchers think that may be because they did not have the equipment to make their membrane as thin: it is 500 micrometres thick, whereas the polymer membranes are generally closer to 130 micrometres thick. Making the wood membranes thinner shouldn't be too hard with the right equipment, Ren says. "The functional part of the membrane is a micrometre thick," he says. "The rest is just a supporting structure to make it harder to break."

New Scientist, 2 August 2019

<http://www.newscientist.com/>

This self-riding bicycle follows you around while you walk

2019-08-07

A computer chip inspired by the brain could pave the way for artificial intelligence with a broader range of abilities. The chip has been used to control an autonomous bicycle, but one day it might power self-driving cars and smart robots. Shi Luping at Tsinghua University in China and his colleagues made the chip with hardware based on the structure of the human brain that can run two types of algorithm. To date, most approaches to developing AIs fall into two camps. The first, and more common, type of algorithm is artificial neural networks, which are simplistic models of neurons designed for specific computer processing tasks such as recognising objects. Then there are biologically inspired circuits, known as spiking neural networks, which are rarer. This aim to more closely replicate the human brain, with its billions of neurons that communicate via electric pulses. Whereas neurons in artificial neural networks can "fire" at different intensities, neurons in spiking neural networks are either on or off. Shi's chip is built to deal with the operations required by both algorithms, so it is potentially more efficient. His team

A computer chip inspired by the brain could pave the way for artificial intelligence with a broader range of abilities.

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has shown how the hybrid chip could be used in an autonomous bicycle. The bike combines several different algorithms for different tasks, allowing it to respond to voice commands, to self-balance, avoid obstacles, and detect and follow a person. Its processor, known as the Tianjic chip, combined five different neural networks, including a spiking neural network that recognises voice commands such as “straight” and “speed up” (Nature, DOI: 10.1038/s41586-019-1424-8). The algorithms were all trained before being loaded onto the chip, where they were run in parallel in the bicycle. Shi says the computer chip could be used for other applications including intelligent robots and self-driving cars. Alessandro Oltramari at engineering firm Bosch says the hybrid chip may be suitable for a variety of tasks. “You really need to have an architecture that is complex enough, that can deal with different problems using different mechanisms,” he says. But more general AIs are still some way off, he adds. Although the Tianjic general ability, it would need to succeed at a range of totally different tasks, such as manipulating objects, playing games or holding a conversation. Oltramari says the chip overlooks a third approach that may be required for artificial general intelligence: cognitive-inspired neural architectures. Instead of trying to replicate the anatomical structures of the brain, this aims to mimic the cognitive abilities of the human mind, such as its ability to pay attention, remember and make predictions.

New Scientist, 3 August 2019

<http://www.newscientist.com/>

Why Sodium-Ion Batteries Don't Last as Long

2019-08-07

Batteries power our lives: we rely on them to keep our cell phones and laptops buzzing and our hybrid and electric cars on the road. But ever-increasing adoption of the most commonly used lithium-ion batteries may actually lead to increased cost and potential shortages of lithium—which is why researchers are focused intensely on sodium-ion batteries as a possible replacement. They perform well, and sodium, an alkali metal closely related to lithium, is cheap and abundant. The challenge? Sodium-ion batteries don't last as long as their lithium-based siblings. “Hydrogen is commonly present during the fabrication of the cathode material, or it can be incorporated from the environment or from the electrolyte,” says co-author Zhen Zhu, who is now at Google. “Hydrogen is known to strongly affect the properties of electronic materials, so we were curious about its effect on NaMnO₂ (sodium manganese dioxide), a common cathode material for sodium-ion batteries.” To study this, the researchers

The unintended presence of hydrogen, which leads to degradation of battery electrodes, is behind the short lifetimes of sodium-ion batteries, according to new research.

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used computational techniques that are capable of predicting the structural and chemical effects that arise from the presence of impurities. Co-author Hartwin Peelaers, now at the University of Kansas, describes the key findings: "We quickly realised that hydrogen can very easily penetrate the material, and that its presence enables the manganese atoms to break loose from the manganese-oxide backbone that holds the material together. This removal of manganese is irreversible and leads to a decrease in capacity and, ultimately, degradation of the battery." "Earlier research had shown that loss of manganese could take place at the interface with the electrolyte or could be associated with a phase transition, but it did not really identify a trigger," says co-author Chris Van de Walle, a computational materials scientist at the University of California, Santa Barbara. "Our new results show that the loss of manganese can occur anywhere in the material, if hydrogen is present. Because hydrogen atoms are so small and reactive, hydrogen is a common contaminant in materials. Now that its detrimental impact has been flagged, measures can be taken during fabrication and encapsulation of the batteries to suppress incorporation of hydrogen, which should lead to better performance." In fact, the researchers suspect that even the ubiquitous lithium-ion batteries may suffer from the ill effects of unintended hydrogen incorporation. Whether this causes fewer problems because fabrication methods are further advanced in this mature materials system, or because there is a fundamental reason for the lithium batteries to be more resistant to hydrogen is not clear at present, and will be an area of future research. The findings appear in the journal *Chemistry of Materials*. Funding for the work came from the Office of Science of the US Department of Energy. The National Energy Research Scientific Computing Centre, with support from the Department of Energy, provided computing resources.

Futurity, 5 August 2019

<http://www.futurity.org>

Next Antibiotic May Come from Dirt Bacteria

2019-08-07

New insight about a broad-spectrum antibiotic agent, obafluorin, made from a fluorescent strain of soil bacteria might offer a powerful antidote to antibiotic resistance, researchers say. Understanding how antibiotic scaffolds construct in nature can help prospect for new classes of antibiotics through DNA sequencing and genome mining. Scientists used this knowledge to help solve the X-ray crystal structure of the enzyme that makes obafluorin. A multi-part enzyme called a non-

New insight about a broad-spectrum antibiotic agent, obafluorin, made from a fluorescent strain of soil bacteria might offer a powerful antidote to antibiotic resistance, researchers say.

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ribosomal peptide synthetase produces the highly reactive beta-lactone ring that is responsible for obafluorin's antimicrobial activity, researchers say. "Obafluorin has a novel structure compared to all FDA-approved antibiotics," says Timothy Wencewicz, assistant professor of chemistry at Washington University in St. Louis. "In the long term, we really need new structural classes of antibiotics that have never been contaminated by clinical resistance from established antibiotic classes." Scientists could use these chemicals as next-generation antibiotics for humans, or even to benefit the agriculture sector, Wencewicz notes—as researchers strive to engineer seed treatments and biopesticides to support plant systems capable of making enough food to feed the 9.6 billion people projected to live on this planet by 2050.

Brand New Compounds

The new work, published in *Nature Communications*, provides a useful road map that shows how individual protein domains in the ObiF1 enzyme stitch together in three-dimensional space. An enzyme's structure is fundamental to almost every function it performs. "The solution of this structure expands on previous discoveries to provide views of the molecular interactions between catalytic domains in a brand-new way," says Andrew M. Gulick, associate professor in the structural biology department in the Jacobs School of Medicine and Biomedical Sciences at the University at Buffalo. "This is a brand-new class of compounds, and we've never had the molecular vision to appreciate how they are produced." Scientists originally discovered obafluorin, made from a fluorescent strain of soil bacteria that forms biofilms on plant roots, in 1984, but it wasn't until 2017 that Wencewicz uncovered the genetic blueprint of the enzyme that makes the molecule's bio-active components. That discovery marked the first time that anyone had been able to pin down a beta-lactone forming enzyme from nature, and recreate it in the laboratory. Like penicillin, obafluorin has a four-membered ring—sometimes called an enchanted ring—that puts strain on bond angles that carbon prefers to adopt. But because a four-member ring is unstable, the molecules are also short-lived and difficult to make. For example, it took years for chemists to learn how to synthesise penicillin from chemicals and then figure out how fungi make it. This ultimately led to the global production of penicillin by fermentation. Researchers in the Wencewicz laboratory were able to fast-track the discovery process using genetics to zero in on the biosynthetic machinery that bacteria use to make obafluorin, and then to reconstruct that multi-step, enzyme-catalysed process in the laboratory.

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Obafluorin Assembly

For the new work, the researchers mapped the full-length non-ribosomal peptide synthetase (NRPS) that makes the bio-active components of obafluorin. The result is a comprehensive, detailed molecular structure at 3 Angstrom resolution that allows scientists to identify the atoms in the protein chain, see their location and points of contact along the chain, and determine how the pieces assemble to produce useful molecules from start to finish. "We were able to catch some of the building blocks of the molecules captured inside some of the enzyme-active sites—in the act of doing the chemistry," Wencewicz says. "This helped us to connect small molecules to the protein, and fill in some of the mechanistic gaps in how the molecules are created." This type of view is particularly important for the future goal of creating a chemical library, populated with related beta-lactone compounds that scientists have engineered for beneficial uses. "We also got a very interesting glimpse at how the domains of the protein actually talk to each other," Wencewicz says. The crystal structures allowed them to see how key components of the enzyme dock to each other, and how molecules are efficiently moved through the entire NRPS assembly line.

Tiny Protein, Big Job

The research found that one particular component—something called an MbtH-like protein, or MLP, because it was first identified in a related system to produce mycobactin in the bacteria that causes tuberculosis—plays a critical role in facilitating protein-to-protein interactions between catalytic domains. "Turns out, the (overall) protein suffers largely when you take away this very little protein that provides the critical handshake," Wencewicz says. "It showed us once and for all that the coordination of these domains is absolutely critical to the function of making antibiotics with this enzyme." Taken as a whole, the new paper is unique in its reach, the researchers say, presenting the X-ray crystal structure of the complete obafluorin-synthesising enzyme ObiF1, probing the molecular mechanism for various key steps in the catalytic cycle, and establishing the conserved residues that enable formation of the reactive beta-lactone ring.

First Step in a Long Process

Finding an antibiotic from a source in nature is only a first step in a long process of drug development, the researchers say. With the structure and techniques reported in the new paper, it is now possible for scientists to quickly and easily create analogues of the natural product in the laboratory—to optimise its molecular properties and bioactivity.

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Gulick and Wencewicz plan to continue to apply their knowledge of the obafluorin biosynthetic pathway to discover new beta-lactone natural products using genomic and biochemical approaches. "Given the structural diversity of known beta-lactone natural products, we believe that novel beta-lactone synthases remain to be discovered," Wencewicz says. Additional co-authors are from Washington University in St. Louis, which has filed a US utility patent covering the technology. The Research Corporation for Science Advancement, the Alfred P. Sloan Foundation, and the National Institutes of Health funded the work.

Futurity, 2 August 2019

<http://www.futurity.org>

Power generation achieved by a self-assembled biofuel cell

2019-08-07

Researchers have developed the first fully functional biofuel cell whose biocatalysts (enzymes that play a critical role in power generation) directly self-assemble onto the electrodes. In about 5 minutes, enzyme-nanoparticle hybrids added to a biofuel cell solution selectively bind to either the anode or the cathode, and in doing so form the key components of the biofuel cell. The researchers, headed by Andreas Stemmer, along with Alexander Trifonov and Ran Tel-Vered, all at the Nanotechnology Group at ETH Zürich, have published a paper on the self-assembled biofuel cells in a recent issue of ACS Nano. "We have demonstrated a self-assembled biofuel cell that provides on-demand power generation that can be switched on and off by a magnetic field," Trifonov told Phys.org. "The system also enables electrodes to be reused multiple times with only exchange of the active elements." In recent years, self-assembly methods have been investigated as a tool for fabricating a variety of nanoscale structures, which have potential applications in fuel cells, batteries, and other energy storage and generation devices. In self-assembly, one of the most common strategies is to use force fields (electric, magnetic, etc.) to make certain regions more energetically favourable to nanoparticles, guiding them to aggregate in these regions. So far, however, a fully functional biofuel cell has not yet been formed using any kind of direct self-assembly method. The biofuel cell reported here is designed to convert fructose-containing fluids, such as grape juice, into electrical power. To do this, the cell uses enzymes as an active element to release electrons from the sugar (through oxidation) into the anode. Then the electrons travel through a wire to the cathode, generating an

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electric current. At the cathode, other enzymes use the electrons (through reduction, the reverse of oxidation) and oxygen present in the solution to produce water. One of the greatest challenges facing biofuel development is immobilising the oxidation- and reduction-catalysing enzymes close enough to the electrodes to ensure that the electrons released from the sugar end up in the oxygen-reduction process. Immobilisation is necessary so that the oxidation and reduction processes occur simultaneously, enabling continuous current flow through the wire. If one of the biofuel cell's compartments (either cathode or anode) does not work properly, the whole process grinds to a halt. This is where the self-assembly process becomes very helpful, as it forces both types of enzymes (oxidation-catalysing and reduction-catalysing) to closely bind to the appropriate electrode (anode or cathode, respectively). The enzymes are first hybridised with carbon-coated magnetic nanoparticles, which themselves are attached to one of two types of ligands, which are molecules with special chemical properties. When a mixture of these enzyme-nanoparticle hybrids is placed in the biofuel cell, reactions between the ligands and electrodes force the oxidation-catalysing enzyme-nanoparticles to bind to the anode, while the reduction-catalysing enzyme-nanoparticles bind to the cathode. This achieves the goal of immobilising the enzymes at the appropriate electrode and allows for uninterrupted oxidation and reduction processes. The researchers also demonstrated another potentially useful feature of the design: disassembly. As the nanoparticles are magnetic, an applied magnetic field causes the enzyme-nanoparticles to detach from the electrodes, terminating the current and releasing the nanoparticles into the electrolyte from which they can be removed. Then a fresh batch of enzyme-nanoparticles can be added, which, like before, self-assemble onto the electrodes. This ability to refresh older, degrading biocatalysts with new ones provides a way to reenergize the cell and prolong its lifetime. The current version of the biofuel cell has a relatively low power output compared to non-self-assembled biofuel cells, but the researchers expect that the performance could be significantly improved with various optimisation techniques, which they plan to investigate in the future. Other areas to explore include tailoring the enzyme-nanoparticles with different molecules for various functions, as well as modifying the cell to use different fuels. "The future plan for this topic is to expand the presented technique for various types of enzymes, which will enable energy harvesting out of many different fuels (such as glucose, lactate, alcohols, etc.)," Trifonov said. "In addition, we aim to extend the lifetime of such biofuel cells, along with testing of different combinations of interactions for the self-assembly process to enlarge the surface area covered by enzyme-magnetic-nanoparticle hybrids (the main problem of

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the demonstrated technology) to enhance the final power output of the device.”

Phys.org, 5 August 2019

<http://phys.org>

Scientists create artificial catalysts inspired by living enzymes

2019-08-07

All living organisms depend on enzymes—molecules that speed up biochemical reactions that are essential for life. Scientists have spent decades trying to create artificial enzymes capable of cranking out important chemicals and fuels at an industrial scale with performance rivalling their natural counterparts. Researchers from Stanford University and SLAC National Accelerator Laboratory have developed a synthetic catalyst that produces chemicals much the way enzymes do in living organisms. In a study published in the Aug. 5 issue of *Nature Catalysis*, the researchers say their discovery could lead to industrial catalysts capable of producing methanol using less energy and at a lower cost. Methanol has a variety of applications, and there is a growing demand for its use as a fuel with lower emissions than conventional gasoline. “We took our inspiration from nature,” said senior author Matteo Cargnello, an assistant professor of chemical engineering at Stanford. “We wanted to mimic the function of natural enzymes in the laboratory using artificial catalysts to make useful compounds.” For the experiment, the researchers designed a catalyst made of nanocrystals of palladium, a precious metal, embedded in layers of porous polymers tailored with special catalytic properties. Most protein enzymes found in nature also have trace metals, like zinc and iron, embedded in their core. The researchers were able to observe trace palladium in their catalysts with electron microscopic imagery by co-author Andrew Herzing of the National Institute of Standards and Technology.

Model reaction

“We focused on a model chemical reaction: converting toxic carbon monoxide and oxygen into carbon dioxide (CO₂),” said Ph.D. student Andrew Riscoe, lead author of the study. “Our goal was to see if the artificial catalyst would function like an enzyme by speeding up the reaction and controlling the way CO₂ is produced.” To find out, Riscoe placed the catalyst in a reactor tube with a continuous flow of carbon

Researchers from Stanford University and SLAC National Accelerator Laboratory have developed a synthetic catalyst that produces chemicals much the way enzymes do in living organisms.

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monoxide and oxygen gas. When the tube was heated to about 150 degrees Celsius (302 degrees Fahrenheit), the catalyst began generating the desired product, carbon dioxide. High-energy X-rays from the Stanford Synchrotron Radiation Lightsource (SSRL) at SLAC revealed that the catalyst had traits similar to those seen in enzymes: The palladium nanocrystals inside the catalyst were continuously reacting with oxygen and carbon monoxide to produce carbon dioxide. And some of the newly formed carbon dioxide molecules were getting trapped in the outer polymer layers as they escaped from the nanocrystals. "The X-rays showed that once the polymer layers were filled with CO₂, the reaction stopped," said Cargnello, an affiliate with the Stanford Natural Gas Initiative (NGI). "This is important, because it's the same strategy used by enzymes. When an enzyme produces too much of a product, it stops working, because the product is no longer needed. We showed that we can also regulate the production of CO₂ by controlling the chemical composition of the polymer layers. This approach could impact many areas of catalysis." The X-ray imaging was conducted by study co-authors Alexey Boubnov, a Stanford postdoctoral scholar, and SLAC scientists Simon Bare and Adam Hoffman.

Making methanol

With the success of the carbon dioxide experiment, Cargnello and his colleagues have turned their attention to converting methane, the main ingredient in natural gas, into methanol, a chemical widely used in textiles, plastics and paints. Methanol has also been touted as a cheaper, cleaner alternative to gasoline fuel. "The ability to convert methane to methanol at low temperatures is considered a holy grail of catalysis," Cargnello said. "Our long-term goal is to build a catalyst that behaves like methane monooxygenase, a natural enzyme that certain microbes use to metabolise methane." Most methanol today is produced in a two-step process that involves heating natural gas to temperatures of about 1,000 C (1,800 F). But this energy-intensive process emits a large amount of carbon dioxide, a potent greenhouse gas that contributes to global climate change. "An artificial catalyst that directly converts methane to methanol would require much lower temperatures and emit far less CO₂," Riscoe explained. "Ideally, we could also control the products of the reaction by designing polymer layers that trap the methanol before it burns."

Future enzymes

"In this work, we demonstrated that we can prepare hybrid materials made of polymers and metallic nanocrystals that have certain traits typical

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of enzymatic activity," said Cargnello, who is also affiliated with Stanford's SUNCAT Centre for Interface Science and Catalysis. "The exciting part is that we can apply these materials to lots of systems, helping us better understand the details of the catalytic process and taking us one step closer to artificial enzymes."

Phys.org, 5 August 2019

<http://phys.org>

From greenhouse gas to fuel

2019-08-07

A growing number of scientists are looking for fast, cost-effective ways to convert carbon dioxide gas into valuable chemicals and fuels. Now, an international team of researchers has revealed a new approach that utilises a series of catalytic reactions to electrochemically reduce carbon dioxide to methane, the main ingredient in natural gas, eliminating an intermediate step usually needed in the reduction process. "We want to supply renewable electricity and take carbon dioxide from the atmosphere and convert it to something else in one step," said Bingjun Xu, a University of Delaware assistant professor of chemical and biomolecular engineering. "This is a key contribution to this vision." The team's results were published in the journal Nature Communications on July 26, 2019. Two of the study authors are based at UD: Xu and postdoctoral associate Xiaoxia Chang. Another study author, Qi Lu of Tsinghua University in China, was formerly a postdoctoral associate in the Department of Chemical and Biomolecular Engineering at UD. The paper's authors also include Haochen Zhen from Tsinghua University, Jingguang Chen from Columbia University, William Goddard III from the California Institute of Technology and Mu-Jeng Cheng from National Cheng Kung University in Taiwan.

A one-pot system

To convert carbon dioxide into valuable fuels, you have to start with a surface made of copper, the metal famous for its use in pennies and electrical wiring. Copper can be used to reduce carbon dioxide into carbon monoxide, which can then be further transformed into substances such as methane. This process is relatively simple, but it requires two reactors and costly separation and purification steps. The research team used computations and experiments to design a one-pot catalysis system. Add carbon dioxide, and a series of chemical reactions will happen without the need to stop and add more chemicals. To do this, the team added special nanostructured silver surfaces, which were developed by Lu when

Scientists have revealed a new approach to convert carbon dioxide gas into valuable chemicals and fuels.

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he was a postdoctoral associate at UD from 2012 to 2015, to the copper surfaces. The silver portion attracts carbon monoxide molecules, which then migrate to the copper portion and reduce to methane. The system yields a higher concentration of methane than copper-only systems. "In this work the primary novelty is to combine these two in a configuration so that several steps of reaction could occur in one system," said Xu. "We systematically modified the composition, the silver-to-copper ratio in the structure. Those are key to the selectivity and ability to combine the reactions." Previous attempts to combine copper with precious metal in this way have failed, but the group developed a special type of electrode structure that enabled the system. The research was the result of a collaborative effort with research groups contributing spectroscopy, computation, and studies of the reactivity of materials.

Science Daily, 1 August 2019

<http://www.sciencedaily.com>

Magnetic 'springs' break down marine microplastic pollution

2019-08-07

Plastic waste that finds its way into oceans and rivers poses a global environmental threat with damaging health consequences for animals, humans, and ecosystems. Now, using tiny coil-shaped carbon-based magnets, researchers in Australia have developed a new approach to purging water sources of the microplastics that pollute them without harming nearby microorganisms. Their work appears July 31 in the journal *Matter*. "Microplastics adsorb organic and metal contaminants as they travel through water and release these hazardous substances into aquatic organisms when eaten, causing them to accumulate all the way up the food chain" says senior author Shaobin Wang, a professor of chemical engineering at the University of Adelaide (Australia). "Carbon nanosprings are strong and stable enough to break these microplastics down into compounds that do not pose such a threat to the marine ecosystem." Although often invisible to the naked eye, microplastics are ubiquitous pollutants. Some, such as the exfoliating beads found in popular cosmetics, are simply too small to be filtered out during industrial water treatment. Others are produced indirectly, when larger debris like soda bottles or tires weather amid sun and sand. To decompose the microplastics, the researchers had to generate short-lived chemicals called reactive oxygen species, which trigger chain reactions that chop the various long molecules that make up microplastics into tiny and

Using tiny coil-shaped carbon-based magnets, researchers have developed a new approach to purging water sources of the microplastics that pollute them without harming nearby microorganisms.

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harmless segments that dissolve in water. However, reactive oxygen species are often produced using heavy metals such as iron or cobalt, which are dangerous pollutants in their own right and thus unsuitable in an environmental context. To get around this challenge, the researchers found a greener solution in the form of carbon nanotubes laced with nitrogen to help boost generation of reactive oxygen species. Shaped like springs, the carbon nanotube catalysts removed a significant fraction of microplastics in just eight hours while remaining stable themselves in the harsh oxidative conditions needed for microplastics breakdown. The coiled shape increases stability and maximises reactive surface area. As a bonus, by including a small amount of manganese, buried far from the surface of the nanotubes to prevent it from leaching into water, the minute springs became magnetic. "Having magnetic nanotubes is particularly exciting because this makes it easy to collect them from real wastewater streams for repeated use in environmental remediation," says Xiaoguang Duan, a chemical engineering research fellow at Adelaide who also co-led the project. As no two microplastics are chemically quite the same, the researchers' next steps will centre on ensuring that the nanosprings work on microplastics of different compositions, shapes and origins. They also intend to continue to rigorously confirm the non-toxicity of any chemical compounds occurring as intermediates or by-products during microplastics decomposition. The researchers also say that those intermediates and by-products could be harnessed as an energy source for microorganisms that the polluting plastics currently plague. "If plastic contaminants can be repurposed as food for algae growth, it will be a triumph for using biotechnology to solve environmental problems in ways that are both green and cost efficient," Wang says. This work was supported by the Australian Research Council, the National Natural Science Foundation of China, and the Science and Technology Program of Guangdong Province.

Science Daily, 31 July 2019

<http://www.sciencedaily.com>

Pesticides deliver a one-two punch to honey bees

2019-08-07

Adjuvants are chemicals that are commonly added to plant protection products, such as pesticides, to help them spread, adhere to targets, disperse appropriately, or prevent drift, among other things. There was a widespread assumption that these additives would not cause a biological reaction after exposure, but a number of recent studies show

Adjuvants not as benign as previously thought

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that adjuvants can be toxic to ecosystems, and specific to this study, honey bees. Jinzhen Zhang and colleagues studied the effects on honey bees when adjuvants were co-applied at “normal concentration levels” with neonicotinoids. Their research, recently published in *Environmental Toxicology and Chemistry*, found that the mixture of the pesticide and the adjuvant increased the mortality rate of honey bees in the lab and in semi-field conditions, where it also reduced colony size and brooding. When applied alone, the three pesticide adjuvants caused no significant, immediate toxicity to honeybees. However, when the pesticide acetamiprid was mixed with adjuvants and applied to honeybees in the laboratory, the toxicity was quite significant and immediate. In groups treated with combined pesticide-adjuvant concentrates, the mortality was significantly higher than the control groups, which included a blank control (no pesticide, no adjuvant, only water) and a control with only pesticide (no adjuvant). Further, flight intensity, colony intensity and pupae development continued to deteriorate long after the application comparative to the control groups. Zhang noted that this study, “contributed to the understanding of the complex relationships between the composition of pesticide formulations and bee harm,” and stressed that “further research is required on the environmental safety assessment of adjuvants and their interactions with active ingredients on non-target species.”

EurekAlert, 5 August 2019

<http://www.eurekalert.org>

In the future, this electricity-free tech could help cool buildings in metropolitan areas

2019-08-07

Engineers have designed a new system that can help cool buildings in crowded metropolitan areas without consuming electricity, an important innovation at a time when cities are working to adapt to climate change. The system consists of a special material -- an inexpensive polymer/aluminium film -- that's installed inside a box at the bottom of a specially designed solar “shelter.” The film helps to keep its surroundings cool by absorbing heat from the air inside the box and transmitting that energy through the Earth's atmosphere into outer space. The shelter serves a dual purpose, helping to block incoming sunlight, while also beaming thermal radiation emitted from the film into the sky. “The polymer stays cool as it dissipates heat through thermal radiation, and can then cool down the environment,” says co-first author Lyu Zhou, a PhD candidate in

Engineers report advancements in radiative cooling in a new study in *Nature Sustainability*

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electrical engineering in the University at Buffalo School of Engineering and Applied Sciences. "This is called radiative or passive cooling, and it's very interesting because it does not consume electricity -- it won't need a battery or other electricity source to realise cooling." "One of the innovations of our system is the ability to purposefully direct thermal emissions toward the sky," says lead researcher Qiaoqiang Gan, PhD, UB associate professor of electrical engineering. "Normally, thermal emissions travel in all directions. We have found a way to beam the emissions in a narrow direction. This enables the system to be more effective in urban environments, where there are tall buildings on all sides. We use low-cost, commercially available materials, and find that they perform very well." Taken together, the shelter-and-box system the engineers designed measures about 18 inches tall (45.72 centimetres), 10 inches wide and 10 inches long (25.4 centimetres). To cool a building, numerous units of the system would need to be installed to cover a roof. The research will be published on Aug. 5 in *Nature Sustainability*. The study was an international collaboration between Gan's group at UB, Boon Ooi's group at King Abdullah University of Science and Technology (KAUST) in Saudi Arabia, and Zongfu Yu's group at the University of Wisconsin-Madison. Along with Zhou, co-first authors are Haomin Song, PhD, UB assistant professor of research in electrical engineering, and Jianwei Liang at KAUST. The study was funded in part by the National Science Foundation. The new passive cooling system addresses an important problem in the field: How radiative cooling can work during the day and in crowded urban areas. "During the night, radiative cooling is easy because we don't have solar input, so thermal emissions just go out and we realise radiative cooling easily," Song says. "But daytime cooling is a challenge because the sun is shining. In this situation, you need to find strategies to prevent rooftops from heating up. You also need to find emissive materials that don't absorb solar energy. Our system addresses these challenges." When placed outside during the day, the heat-emanating film and solar shelter helped reduce the temperature of a small, enclosed space by a maximum of about 6 degrees Celsius (11 degrees Fahrenheit). At night, that figure rose to about 11 degrees Celsius (about 20 degrees Fahrenheit). The new radiative cooling system incorporates a number of optically interesting design features. One of the central components is the polymer/metal film, which is made from a sheet of aluminium coated with a clear polymer called polydimethylsiloxane. The aluminium reflects sunlight, while the polymer absorbs and dissipates heat from the surrounding air. Engineers placed the material at the bottom of a foam box and erected a solar "shelter" atop the box, using a solar energy-absorbing material to construct four outward-slanting walls, along with an inverted square cone within those walls. This

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architecture serves a dual purpose: First, it helps to sponge up sunlight. Second, the shape of the walls and cone direct heat emitted by the film toward the sky. "If you look at the headlight of your car, it has a certain structure that allows it to direct the light in a certain direction," Gan says. "We follow this kind of a design. The structure of our beam-shaping system increases our access to the sky. The ability to direct the emissions improves the performance of the system in crowded areas."

EurekaAlert, 5 August 2019

<http://www.eurekaalert.org>

Lab produces simple fluorescent surfactants

2019-08-07

Laboratories use surfactants to separate things, and fluorescent dyes to see things. Rice University chemists have combined the two to simplify life for scientists everywhere. The Wiess School of Natural Sciences lab of chemist Angel Martí introduced a line-up of eight fluorescent surfactants in Pure and Applied Chemistry. They're examples of what he believes will be a modular set of fluorescent surfactants for labs and industry. Martí and Rice graduate student and lead author Ashleigh Smith McWilliams developed the compounds primarily to capture images of single nanotubes or cells as simply as possible. "We can stain cells or carbon nanotubes with these surfactants," Martí said. "They stick to cells or nanotubes and now you can use fluorescent microscopy to visualise them." Soaps and detergents are common surfactants. They are two-part molecules with water-attracting heads and water-avoiding tails. Put enough of them in water and they will form micelles, with the heads facing outward and the tails inward. (Similar structures form the protective, porous barriers around cells.) McWilliams produced the surfactants by reacting fluorescent dyes with alcohol-based, nonpolar tails, which made the heads glow when triggered by visible light. When the compounds wrap around carbon nanotubes in a solution, they not only keep the nanotubes from aggregating but make them far easier to see under a microscope. "Surfactants have been used for many different applications for years, but we've made them special by converting them to image things you can generally not see," Martí said. "Fluorescent surfactants have been studied before, but the novel part of ours is their versatility and relative simplicity," McWilliams said. "We use common dyes and plan to produce these surfactants with an array of colours and fluorescent properties for specific applications." Those could be far-reaching, Martí said. "These can go well beyond imaging applications," he said. "For

Rice University chemists have produced an array of fluorescent surfactants for imaging, biomedical and manufacturing applications.

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instance, clothing manufacturers use surfactants and dyes. In theory, they could combine those; instead of using two different chemicals, they could use one. "I can also envision using these for water purification, where surfactant dyes can be tuned to trap pollutants and destroy them using visible light," Martí said. "For biomedical applications, they can be tuned to target specific cells and kill only those you radiate with light. That would allow for a localised way to treat, say, skin cancer." Martí said his lab was able to confirm fluorescent surfactants are the real deal. "We were able to characterise the critical micelle concentration, the concentration at which micelles start forming," he said. "So, we are 100% sure these molecules are surfactants."

Phys.org, 5 August 2019

<http://phys.org>

Granular aluminium for future computers

2019-08-07

Computers based on quantum mechanical principles can solve certain tasks particularly efficiently. Their information carriers, the so-called qubits, not only have the values "0" and "1," but also states in between, called superposition states. However, maintaining such a state is difficult. Scientists at the Karlsruhe Institute of Technology (KIT) have now used granular aluminium (nicknamed grAl) for qubits and have shown that this superconducting material has great potential to overcome the previous limits of quantum hardware. The researchers report in the journal Nature Materials. Quantum computers are considered the computers of the future. You can in principle process large amounts of data much quicker than with current classical computers. While classical computers perform one step at a time, quantum computers can be regarded as taking many steps in parallel, in so-called quantum parallelism. The information carrier for the quantum computer is the quantum bit, qubit in short. For qubits not only the states "0" and "1" are relevant, but also the states in between, the quantum mechanical superposition of states. Their processing is done according to quantum mechanical principles, such as entanglement, which preserves instant correlations between qubit states to arbitrary long distances. "Producing qubits that are small enough and that can be switched quickly enough to perform quantum calculations is a huge challenge," explains physicist Dr. Ioan Pop, Head of the Kinetic Inductance Quantum Systems research group at the Physics Institute (PHI) and KIT's Institute of Nanotechnology (INT). A promising option is superconducting circuits. Superconductors are materials that have no electrical resistance

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at extremely low temperatures, therefore they conduct electricity without losses. This is crucial in order to preserve the quantum states and to smoothly interconnect qubits, resulting in higher computing power. Big companies like IBM, Intel, Microsoft and Google are working to scale up superconducting quantum processors. One major difficulty, however, is maintaining the quantum state. Interactions with the environment can lead to the decay of the quantum state, the so-called decoherence. The more qubits are used, the harder it is to maintain coherence. Researchers at the PHI, INT and IPE of KIT and the National University for Research and Technology MISIS in Moscow have now used for the first-time granular aluminium as superconducting material for high coherence qubits. As the scientists report in the journal Nature Materials, they measured a grAl fluxonium qubit with coherence time of up to 30 microseconds—this is the time in which the qubit can remain in a state between “0” and “1”. This time may sound short, but it is actually encouragingly long compared with the typical 0.01 microsecond time required for the qubit operation. “Our results show that granular Aluminium can open avenues of research for a new class of complex qubit designs and help overcome the current limitations of quantum computing,” explains Dr. Ioan Pop from the KIT.

Phys.org, 1 August 2019

<http://phys.org>

Promising new solar-powered path to hydrogen fuel production

2019-08-07

Engineers at Lehigh University are the first to utilize a single enzyme biomineralisation process to create a catalyst that uses the energy of captured sunlight to split water molecules to produce hydrogen. The synthesis process is performed at room temperature and under ambient pressure, overcoming the sustainability and scalability challenges of previously reported methods. Solar-driven water splitting is a promising route towards a renewable energy-based economy. The generated hydrogen could serve as both a transportation fuel and a critical chemical feedstock for fertiliser and chemical production. Both of these sectors currently contribute a large fraction of total greenhouse gas emissions. One of the challenges to realising the promise of solar-driven energy production is that, while the required water is an abundant resource, previously-explored methods utilise complex routes that require environmentally-damaging solvents and massive amounts of energy to produce at large scale. The expense and harm to the environment have

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made these methods unworkable as a long-term solution. Now a team of engineers at Lehigh University have harnessed a biomineralisation approach to synthesising both quantum confined nanoparticle metal sulfide particles and the supporting reduced graphene oxide material to create a photocatalyst that splits water to form hydrogen. The team reported their results in an article entitled: "Enzymatic synthesis of supported CdS quantum dot/reduced graphene oxide photocatalysts" featured on the cover of the August 7th issue of Green Chemistry, a journal of the Royal Society of Chemistry. The paper's authors include: Steven McIntosh, Professor in Lehigh's Department of Chemical and Biomolecular Engineering, along with Leah C. Spangler, former Ph.D. student and John D. Sakizadeh, current Ph.D. student; as well, as Christopher J. Kiely, Harold B. Chambers Senior Professor in Lehigh's Department of Materials Science and Engineering and Joseph P. Cline, a Ph.D. student working with Kiely. "Our water-based process represents a scalable green route for the production of this promising photocatalyst technology," said McIntosh, who is also Associate Director of Lehigh's Institute for Functional Materials and Devices. Over the past several years, McIntosh's group has developed a single enzyme approach for biomineralization -- the process by which living organisms produce minerals of size-controlled, quantum confined metal sulfide nanocrystals. In a previous collaboration with Kiely, the lab successfully demonstrated the first precisely controlled, biological way to manufacture quantum dots. Their one-step method began with engineered bacterial cells in a simple, aqueous solution and ended with functional semiconducting nanoparticles, all without resorting to high temperatures and toxic chemicals. The method was featured in a New York Times article: "How a Mysterious Bacteria Almost Gave You a Better TV." "Other groups have experimented with biomineralization for chemical synthesis of nanomaterials," says Spangler, lead author and currently a Postdoctoral Research Fellow at Princeton University. "The challenge has been achieving control over the properties of the materials such as particle size and crystallinity so that the resulting material can be used in energy applications." McIntosh describes how Spangler was able to tune the group's established biomineralization process to not only synthesise the cadmium sulfide nanoparticles but also to reduce graphene oxide to the more conductive reduced graphene oxide form. "She was then able to bind the two components together to create a more efficient photocatalyst consisting of the nanoparticles supported on the reduced graphene oxide," says McIntosh. "Thus, her hard work and resulting discovery enabled both critical components for the photocatalyst to be synthesized in a green manner." The team's work demonstrates the utility of biomineralisation to realise benign synthesis of functional materials for

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use in the energy sector. "Industry may consider implementation of such novel synthesis routes at scale," adds Kiely. "Other scientists may also be able to utilize the concepts in this work to create other materials of critical technological importance." McIntosh emphasises the potential of this promising new method as "a green route, to a green energy source, using abundant resources." "It is critical to recognise that any practical solution to the greening of our energy sector will have to be implemented at enormous scale to have any substantial impact," he adds.

Science Daily, 1 August 2019

<http://www.sciencedaily.com>

'Sniff-cam' to detect disease by analysing bad breath

2019-08-07

Having bad breath can mean someone ate a smelly lunch, but it could indicate that the person is sick. Various scent compounds have been linked to illnesses such as diabetes, lung cancer and Parkinson's disease, leading scientists to develop technology that measures these substances. However, the challenge is creating instrumentation that can detect low, diagnostic levels of these disease biomarkers. Now, scientists report in ACS' Analytical Chemistry a highly sensitive "sniff-cam" that fits the bill. Before the advent of modern technology, ancient medical practitioners used breath and body odour to diagnose disease. But healthy people also emit smelly volatile organic compounds (VOCs), and the levels of these substances can vary depending on other factors, such as sex and body mass, so analysis can be complicated. Over the years, researchers have developed several different types of instruments to detect VOCs, such as ethanol (EtOH), a metabolite of the microbiome in humans that can provide an indication of glucose levels. But current systems to detect VOCs typically require large, expensive equipment and trained professionals. Previously, Kohji Mitsubayashi and colleagues developed a "bio-sniffer" that measured VOCs, such as acetone, a product of lipid metabolism. More recently, they reported the first-generation sniff-cam, which could visualise EtOH emissions from the skin of someone who had consumed alcohol. However, the researchers wanted to refine the device so it could detect diagnostic levels of biomarkers. The researchers constructed a new version of the sniff-cam, which now consists of an ultraviolet ring light, filters and a camera. An enzyme mesh, already used in the previous device, reacts EtOH with oxidised nicotinamide adenine dinucleotide (NAD), producing the fluorescent reduced form of NAD, which the camera records. A new imaging analysis method improved the sensitivity of the system so that

Having bad breath can mean someone ate a smelly lunch, but it could indicate that the person is sick. Now, scientists report the development of a highly sensitive 'sniff-cam'.

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low amounts of EtOH could be measured. The updated sniff-cam was then tested on a group of male subjects who had not consumed food or drink, and the device detected miniscule levels of EtOH in their breath. These results show that the sniff-cam can visualise a broader range of VOC levels than previous devices, and its versatility may aid in the further study of the relationship between scent and disease.

Science Daily, 31 July 2019

<http://www.sciencedaily.com>

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Mounting Evidence Says Trees - But Not Grass - Improve Our Mental Health. Here's Why

2019-08-08

Increasing tree canopy and green cover across Greater Sydney and increasing the proportion of homes in urban areas within 10 minutes' walk of quality green, open and public space are among the New South Wales premier's new priorities. Cities around Australia have similar goals. In our latest study, we asked if more of any green space will do? Or does the type of green space matter for our mental health? Our results suggest the type of green space does matter. Adults with 30 percent or more of their neighbourhood covered in some form of tree canopy had 31 percent lower odds of developing psychological distress. The same amount of tree cover was linked to 33 percent lower odds of developing fair to poor general health. We also found poorer mental and general health among adults in areas with higher percentages of bare grass nearby, but there's likely more to that than meets the eye.

How did we do the research?

Our research involved tracking changes in health over an average of about six years, for around 46,000 adults aged 45 years or older, living in Sydney, Newcastle or Wollongong. We examined health in relation to different types of green space available within a 1.6 kilometre (1 mile) walk from home. Our method helped to guard against competing explanations for our results, such as differences in income, education, relationship status, sex, and age. We also restricted the sample to adults who did not move home, because it is plausible that people who are already healthier (for instance because they are more physically active) move into areas with more green space. So, is the answer simply more trees and less grass? Not exactly. Let's get into the weeds.

Trees make it cool to walk

Imagine you're walking down a typical street on a summer's day in the middle of an Australian city. It's full of right angles, grey or dark hard surfaces, glass structures, and innumerable advertisements competing for your attention. Then you turn a corner and your gaze is drawn upwards to a majestic tree canopy exploding with a vivid array of greens for as far as you can see. Let's get the obvious out of the way. Walking down this green street, you may instantly feel some relief from the summer heat. Studies are linking high temperatures with heat exhaustion and mental health impacts. Research has suggested trees, rather than other forms of

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green space, may be best at reducing temperatures in cities. It may also simply be more comfortable to walk outside in cooler temperatures – not to mention going for a run or bike ride, both of which are good for mental health.

Feeling restored and alert

But as the minutes of walking beneath this natural umbrella of lush foliage accumulate, other things are happening too. The vibrant colours, natural shapes and textures, fresh aromas, and rustling of leaves in the breeze all provide you with effortless distraction and relief from whatever it was you might have been thinking about, or even stressing over. Studies back this up. Walks through green space have been shown to reduce blood pressure, improve mental acuity, boost memory recall, and reduce feelings of anxiety. The Japanese have a name for this type of experience: shinrin-yoku.

Friends, old and new

You walk past groups of people on the footpath taking time to catch up over coffee in the shade. Some research has found that tree cover, rather than green space more generally, is a predictor of social capital. Social capital, according to Robert Putnam, refers to the “social networks and the associated norms of reciprocity and trustworthiness” that may have important influences on our life chances and health. You walk further and a chorus of birdsong soars through the neighbourhood noise. Trees provide shelter and food for a variety of animals. Research suggests tree canopy tends to be more biodiverse than low-lying vegetation. Increased biodiversity may support better mental health by enhancing the restorative experience and also via the immunoregulatory benefits of microbial “Old Friends” – microorganisms that helped shape our immune systems but which have been largely eliminated from our urban environments. Green spaces with tree canopy are settings where communities can come together to watch birds and other animals, which can also be catalysts for new conversations and developing feelings of community belonging in the neighbourhoods where we live ... just ask dog owners.

So, what about the grass?

Our research did not show a mental health benefit from more bare grassed areas. This does not mean grass is bad for mental health. Previous research suggests adults are less likely to wander in green spaces that are relatively plain and lacking in a variety of features or amenities. This may also be

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partly attributable to preferences for green spaces with more complex vegetation, such as parks that mix grass with tree canopy. Furthermore, large areas of bare grass in cities can make built environments more spread-out and less dense. Without tree canopy to shield from the midday sun, this may increase the likelihood of people using cars for short trips instead of walking through a park or along a footpath. The result is missed opportunities for physical activity, mental restoration, and impromptu chats with neighbours. Previous work in the United States suggests this might be why higher death rates were found in greener American cities. Large open areas of grass can be awesome for physical activity and sport, but let's make sure there is also plenty of tree canopy too, while also thinking about ways to get more people outdoors in green spaces. Here are some suggestions.

Making Australia greener and healthier

As the density of Australian cities continues to increase and more of us live in apartments and/or work in high-rise office blocks, it is great to see strategies to invest in tree cover and urban greening more generally across Australia. Cities with such plans include Sydney, Melbourne, Brisbane, Bendigo, Fremantle, and Wollongong. You can get involved and have some fun at the same time too. Lots of evidence says gardening is really great for your mental health. So why not grab a mate and spend a couple of hours planting a tree.

Science Alert, 29 July 2019

<http://www.sciencealert.com.au>

More evidence ties extreme hypertension in pregnancy to long-term problems

2019-08-08

Women who develop preeclampsia, a form of dangerously high blood pressure during pregnancy, may face a wide variety of heart problems long after they give birth, a research review concludes. Preeclampsia has long been linked to an increased risk of events like heart attacks and strokes years later, but women often don't experience symptoms until they have a life-threatening problem. For the current analysis, researchers examined results from 13 previously published studies that assessed women's hearts with echocardiography to look for early warning signals. "Previous studies had demonstrated cardiac dysfunction in women with a history of pre-eclampsia but this paper brings together the results of

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those studies to try and better understand the extent of the problem and the patterns of dysfunction," said lead author Archana Thayaparan, a researcher at Western Health in Victoria, Australia. "This is important for patients as no large studies have been done to investigate this, and most women with pre-eclampsia are unaware of the potential long-term consequences and increased risk of heart disease and stroke," Thayaparan said by email. So-called gestational hypertension, when women who normally don't have high blood pressure develop it during pregnancy, is fairly common, affecting 6% to 8% of pregnant women. This condition can progress to a more serious and potentially life-threatening version of high blood pressure known as preeclampsia later in pregnancy. Women with preeclampsia are more likely to develop "diastolic dysfunction," which happens when the heart doesn't fill with blood properly and is a precursor to a form of heart failure. In the study, about 19 percent of women with a history of preeclampsia developed diastolic dysfunction, compared with 5.4% of women with uncomplicated pregnancies. With a history of preeclampsia, about 25% of women went on to develop heart failure within 4 to 10 years of giving birth, compared with 7% of women with uncomplicated pregnancies, researchers note in the Australasian Journal of Ultrasound Medicine. This suggests that women with a history of preeclampsia should get regular echocardiograms to monitor their hearts for changes that might not yet be causing any symptoms, the study authors conclude. The study wasn't designed to determine whether preeclampsia directly causes later heart problems, or if it might be an early sign of existing problems that emerge under the pressure of pregnancy on a woman's body. "Previous research has shown that traditional cardiovascular risk factors such as BMI and blood pressure play a central role in the development of cardiovascular disease in women who experienced preeclampsia," said Eirin Haug, a public health researcher at the Norwegian University of Science and Technology in Trondheim, who wasn't involved in the study. Doctors currently advise women with a history of preeclampsia to make lifestyle changes like losing weight, exercising, and eating a heart-healthy diet and to get regular blood pressure checks, Haug said by email. "We still lack evidence for the effect of screening and lifestyle modifications on reducing cardiovascular risk in these women," Haug said. "More research is needed to tailor effective strategies to prevent cardiovascular disease in this group of women."

Reuters Health, 26 July 2019

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

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'Second-Hand Drinking' Is the Public Health Problem You've Probably Never Heard Of

2019-08-08

It's easy to imagine how second-hand smoke can impact an innocent bystander - most of us have probably inhaled the smoke from someone else's tobacco without wanting to. But it's not the only habit that can affect others; 'second-hand drinking' is a thing, too. It's not quite as literal, as it doesn't mean the alcohol you drink will end up in the bloodstream of another. But over the years it's become increasingly clear that second-hand drinking is a significant public health issue. Now, a study in the United States has placed its effects on par with second-hand smoking. Using US national survey data from 2015, research has found that each year, one in five American adults - which is an estimated 53 million people - experience harm because of someone else's drinking. These harms include things like threats or harassment, which was the most commonly cited, as well as physical aggression, drunk driving, and even financial or family problems. What's more, the authors found that the burden of second-hand drinking was not experienced equally. Young people under the age of 25 were mostly on the receiving end, and in the year previous to the survey, some 21 percent of women and 23 percent of men said they experienced harm because of someone else's alcohol use. For men, this harm was usually from a stranger and resulted in ruined property, vandalism, or physical aggression. But for women, the drinker tended to be a family member, causing financial issues or problems in the house. The authors of the study conclude that their findings substantiate previous research "documenting the considerable risk for women from heavy, often male, drinkers in the household and, for men, from drinkers outside their family." "Further," they add, "our findings are consistent with recent data from outside the United States that highlight the significance of the proximity of male harmful drinkers for women's victimisation by others who have been drinking." The results, which were based on two telephone surveys of 8,750 adults, found that even people who drank but not heavily were more than doubly at risk of experiencing harassment, threats, and driving-related harm from someone else's drinking. (In this case, heavy drinking was defined as five or more alcoholic beverages at a time at least monthly for men, and four or more alcoholic beverages for women). Most of us know that alcohol comes with its fair share of health problems for the individual, but in a commentary published alongside the new paper, Sven Andréasson, a physician at the Karolinska Institutet of Stockholm, says that's only a part of the impact. "When researchers compare the relative impact of different substances on the users and others, alcohol stands out as the substance

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that by far causes the most harm to others," he writes. "When combining harms to the users with harms to others, alcohol again scores highest, ahead of tobacco, heroin, cocaine, and other substances." In 2015, the US Centres for Disease Control and Infection announced that 58 million non-smokers in the US are still exposed to second-hand smoke. This is around the same level of people estimated to have experienced harm from second-hand drinking, a number which is likely an underestimate. Just as research on second-hand smoke led the way to better controls on smoking, the authors hope their research will spur legislation to reduce the health burden of alcohol. "Among policies, taxes have strong evidence of reducing not only excessive drinking but outcomes in which second-hand effects are prevalent," writes Timothy Naimi, a physician at the Boston Medical Centre in another accompanying commentary. "And yet recently federal alcohol taxes have been cut, specific excise taxes in states have eroded by more than 30 [percent] in inflation-adjusted terms during the past 25 years, and current tax revenues only account for a fraction of alcohol-related costs." It's about time we started taking second-hand drinking more seriously. The research has been published in the *Journal of Studies on Alcohol and Drugs*.

Science Alert, 28 July 2019

<http://www.sciencealert.com.au>

The Way Our Brain Values Information Suggests It Can Be Addictive, Like Food or Drugs

2019-08-08

You might be familiar with getting hooked on booze, chocolate, or caffeine. But what about the sweet, sweet thrill of an information overload? Info can act like snacks, money and drugs on our brain, new research has found. That means we tend to seek out an information hit whether or not it's going to be useful, just like we might snack when we're not hungry. You know all those times you check your phone when you're not expecting any messages? This is what's happening. The researchers behind the work say it could offer important insights into how digital addiction works on the brain, whether that's clicking on questionable headlines or finding yourself tagged in someone else's social media photos. "To the brain, information is its own reward, above and beyond whether it's useful," says neuroeconomist Ming Hsu, from the Haas School of Business at the University of California, Berkeley. "And just as our brains like empty calories from junk food, they can overvalue information that makes us feel good but may not be useful – what some may call idle

Information can act like snacks, money and drugs on our brain, new research has found.

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curiosity." Together with his UC Berkeley colleague, neuroscientist Kenji Kobayashi, Hsu analysed fMRI brain scans of 37 volunteers while they were engaged in a gambling game. The players had to decide how much to pay to discover the odds on a series of lotteries, before choosing whether to take part in the lottery or not. In other words, they were being asked to put a value on information. In some cases – if the odds on the lottery turned out to be short – that information was useful. In general, the volunteers tended to overvalue the extra details they could pay to get. Lotteries with higher stakes made people more curious about what they could find out and more willing to pay to get the odds – even if that extra information turned out to have no impact on their decision to play a particular lottery or not. "Our study tried to answer two questions," says Hsu. "First, can we reconcile the economic and psychological views of curiosity, or why do people seek information? Second, what does curiosity look like inside the brain?" The economic view of curiosity is that it's a tool we use to get useful information. The psychological view is that curiosity is innate, a motivation in itself – irrespective of what curiosity gets us in terms of usefulness. It seems both of these were at play in the researchers' experiment. The sort of overvaluing of information that the test showed up matches the way we might check the odds on a sports match we have no intention of betting on, for example; or how we might want to know if we've got a job offer even if we're not going to accept it. Although we must note the very small sample size in this study, the brain scans did show some curious information. The fMRI data indicated that getting information on a lottery's odds showed increased activation in parts of the brain known to be involved in valuation – the striatum and the ventromedial prefrontal cortex (VMPFC). Via a machine learning analysis, the researchers also showed that the same 'neural code' we use to assess monetary reward was used to assess lottery odds as well – so we can convert information into a concrete value, in other words. As a fascinating next step, this research also ties into previous studies on animals that show information can be a reward in itself, even if we're not going to get any other tangible benefit from it. With so much information at our fingertips and more pouring in each day, understanding how we respond to this resource could help us better discern how that affects our relationship with information technology in general - such as why we find phone pings and email alerts so irresistible. "We were able to demonstrate for the first time the existence of a common neural code for information and money, which opens the door to a number of exciting questions about how people consume, and

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sometimes over-consume, information,” says Hsu. The research has been published in PNAS.

Science Alert, 28 July 2019

<http://www.sciencealert.com.au>

China is on track to meet its climate change goals nine years early

2019-08-08

China appears on track to reach its carbon goals up to nine years earlier than planned under the Paris agreement, in a potential huge boost for efforts to tackle climate change. The world's biggest polluter accounts for a quarter of humanity's emissions today, making the nation a crucial part of any efforts to avoid dangerous global warming. Now an analysis has found that China's emissions could peak at 13 to 16 gigatonnes of CO₂ between 2021 and 2025, making what the researchers call a “a great contribution” to meeting the Paris deal's goal of limiting temperature rises to 2°C. The official target is a peak by “around 2030.” “It reflects China's great efforts in mitigating climate change and the ‘new normal’ of the economy, from high speed to high quality, which might cause CO₂ emissions to peak earlier,” says Haikun Wang of Nanjing University. His Chinese-US team calculated their dates by looking at historical carbon emissions and GDP data for 50 Chinese cities between 2000 and 2016. They found that emissions tend to peak at 10.2 tonnes of CO₂ per person when GDP hits around \$21,000 per person. The cities are responsible for 35 per cent of China's total emissions, from which the researchers extrapolated a national picture, projecting it forward to find a peak. The possibility of China delivering early on its international target will be a boost for UN climate talks. Under the Paris deal, countries are due to submit revised and improved carbon targets next year. The possibility of an early peak has been driven by the changing nature of China's economy, a shift which is likely to continue. “As China moves towards a higher tech and service economy, it is likely to show how the passage to a low-carbon economy and robust and sustainable growth in an emerging market economy can be mutually supportive,” says Nicholas Stern, of the London School of Economics. The expectation of a peak by 2025 is in line with the lower end of other projections. However, Haikun and colleagues admit they didn't analyse many small cities, which have the potential to develop more, so the real emissions may end up higher. The US-based thinktank World Resources Institute also says that while more countries are peaking emissions – 57 are due by 2030, up from

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19 in 1990 – it will still not be enough to make global emissions peak in the next few years.

New Scientist, 26 July 2019

<http://www.newscientist.com/>

Antihistamines for kids with a cold: risks without benefits?

2019-08-08

Despite risks and no clear benefits, doctors are increasingly likely to recommend antihistamines for children under the age of 12 who have a cold, according to a new study. Antihistamines are widely used over-the-counter to treat various allergic conditions. They have little known benefit for children with colds, however, and some older antihistamines (e.g., diphenhydramine or Benadryl) cause sedation and occasionally agitation in children. The study, which appears in *JAMA Pediatrics*, finds a sharp decline in cough and cold medicine recommendations for children under 2 after 2008, when the Food and Drug Administration recommended against the medicines for that age group due to safety concerns and uncertain benefits. The American Academy of Paediatrics subsequently recommended avoiding cough and cold medicines in children under 6. "Families often treat their children's respiratory infections with cough and cold medicines, some of which include opioid ingredients, such as codeine or hydrocodone. However, there is little proof that these medications effectively ease the symptoms in young children," says lead author Daniel Horton, assistant professor of paediatrics, Rutgers Robert Wood Johnson Medical School. "Also, many cough and cold medicines have multiple ingredients, which increases the chance of serious accidental overdose when combined with another product." The researchers looked at national surveys representing 3.1 billion paediatric ambulatory clinic and emergency department visits in the United States from 2002 to 2015. During that period, physicians ordered approximately 95.7 million cough and cold medications, 12 percent of which contained opioids. After the FDA's 2008 public health advisory, however, physician recommendations declined by 56% for non-opioid cough and cold medicines in children under 2 and by 68% for opioid-containing medicines in children under 6. At the same time, researchers saw a 25% increase in doctor recommendations for antihistamines to treat respiratory infections in children under 12. "Sedating antihistamines such as diphenhydramine [Benadryl] may have a small effect on some cold symptoms in adults," Horton says. "However, there is little evidence that antihistamines actually

Despite risks and no clear benefits, doctors are increasingly likely to recommend antihistamines for children under the age of 12 who have a cold, according to a new study.

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help children with colds feel better or recover faster. We do know that these medicines can make kids sleepy and some kids quite hyper.” “It is nice to see physicians are heeding the advice to avoid cough and cold medications for children, but switching them to antihistamines is not necessarily an improvement,” says co-author Brian Strom, chancellor, Rutgers Biomedical and Health Sciences. The American Academy of Paediatrics has various suggestions for treating children with the cold or flu, including use of over-the-counter medicines for pain or fever, honey to relieve cough in children who are over 1 year old, and plenty of rest and hydration.

Futurity, 29 July 2019

<http://www.futurity.org>

New medical procedure could delay menopause by 20 years

2019-08-08

A medical procedure that aims to allow women to delay the menopause for up to 20 years has been launched by IVF specialists in Britain. Doctors claim the operation could benefit thousands of women who experience serious health problems, such as heart conditions and bone-weakening osteoporosis, that are brought on by the menopause. But the specialists believe the same procedure could also improve the lives of millions more women by delaying the onset of more common symptoms of the menopause, which range from low mood, anxiety and difficulty sleeping, to hot flushes, night sweats and a reduced sex drive. The procedure, which costs between £7,000 and £11,000, is being offered to women up to the age of 40 through ProFam, a Birmingham-based company set up by Simon Fishel, an IVF doctor and president of the UK Care Fertility Group, in collaboration with other specialists. “This has the potential to be of significant benefit to any woman who may want to delay the menopause for any reason, or those women who would have taken HRT, and there are lots of benefits around that,” Prof Fishel told the Guardian. Nine women have so far had the procedure to remove and freeze their ovarian tissue with a view to delaying the menopause when they are older. Doctors use keyhole surgery to remove a small piece of ovarian tissue, which is then sliced up and frozen to preserve it. When the women enter the menopause, potentially decades from now, the frozen tissue can be thawed out and grafted back into the body. To restore falling hormone levels, doctors typically choose a site with a good blood supply, such as the armpit. Provided the ovarian tissue survives the process, it should

Operation could benefit thousands of women who experience serious health issues

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restore the woman's declining sex hormones and halt the menopause. "This is the first project in the world to provide healthy women ovarian tissue cryopreservation purely to delay the menopause," the company's chief medical officer, Yousri Afifi, told the Sunday Times. Doctors already use a similar procedure to protect the fertility of girls and women who are about to have cancer treatment. Before they begin anti-cancer therapy, doctors remove some ovarian tissue and freeze it. If the woman wishes to have children in the future, the tissue is then thawed out and reimplanted next to the fallopian tubes, which pick up the mature eggs that are released by the tissue. How much the new procedure will delay the menopause depends on the age when the tissue is taken and when it is put back. Tissue taken from a 25-year-old might postpone the menopause for 20 years, while that taken from a 40-year-old might only delay its onset for five years. Fishel points out that young women today can expect to spend 30 to 40 years in the menopausal stage and while many will benefit from hormone replacement therapy, it does not suit everyone. Richard Anderson, the deputy director of the Centre for Reproductive Health at Edinburgh University, has performed ovarian tissue freezing for young girls and women for 25 years. He said it was "old news" that the transplants could restore hormone levels, but added: "What is less clear is whether this is a safe and effective way of doing so." Beyond postponing menopause, the doctors believe the procedure could save the NHS substantial amounts of money by reducing treatment costs for the menopause and more serious, related problems such as heart conditions and osteoporosis. But it could also be a game-changer for fertility treatment. Unlike IVF, ovarian tissue preservation does not require drugs to stimulate the ovaries, and is likely to produce far more eggs. If women in their 20s routinely had ovarian tissue removed and stored, Fishel said, they could potentially have access to thousands of eggs should they later decide to have children. Women could even have part of their tissue reimplanted to restore their fertility before starting a family, and the rest regrafted later to hold off the menopause, he said.

The Guardian, 4 August, 2019

<http://www.guardian.com>

Haider Warraich: 'We do everything in our modern lifestyle to hurt the heart'

2019-08-08

Haider Warraich is a cardiologist at Duke University Medical Centre in Durham, North Carolina. His medical training began in his native Pakistan,

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and this autumn he will join the faculty of Brigham and Women's hospital at Harvard Medical School and the VA Boston (Department of Veterans Affairs medical facilities). In his book *State of the Heart*, he looks at the history, science and future of cardiac disease, and argues that it has become an overlooked condition.

People are more likely to survive a heart attack today, but heart disease is still the biggest killer worldwide. Why is that? In the last few decades we've changed a heart attack from an almost certainly fatal diagnosis to one the vast majority of patients can recover from. However, those advances mean people live long enough that they develop other conditions, including heart failure, which is a chronic condition in which the heart is unable to get blood to the entire body. What kills people today is chronic disease. Unless we change our health system to focus on chronic diseases, and have contact with patients throughout their lives rather than just waiting for them to get sicker, we're going to keep having this disconnect.

What's the biggest advance in heart health you think has gone unnoticed?

Until recently, open heart surgery was the only way that you would treat a condition called aortic stenosis. The aortic valve is the last valve in the heart that blood has to flow through to be able to get to the rest of the body. As we get older, it starts to thicken and harden. That increases the amount of pressure the heart has to beat against to force blood into the body, and can cause a lot of strain on the heart. But the last decade has seen the development of a new procedure called transcatheter aortic valve replacement (TAVR). Cardiologists are able to replace the valve through a minimally invasive procedure. They insert this valve through the veins in your leg and snake it up all the way to your heart. Recently Mick Jagger got this procedure done and just days after he was back touring, he was dancing – you would have no idea that he'd had this performed.

You suggest that one reason people don't take heart disease seriously is because they think that when someone gets heart disease it's their own fault. How much does diet feed into our heart health?

For many patients it's not something they have any control over. For example, if a woman who gave birth develops postpartum cardiomyopathy, there's nothing she could have done to avoid it. At the same time, there's a lot of heart disease for which you can reduce the risk by instituting lifestyle changes. We do everything in our modern lifestyle to hurt the heart: there's very little aerobic exercise in our daily routines, the food we eat is highly processed, the salt we consume is so much more

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than we need, and there's so much stress we experience. It seems like every fact of life has been designed to add fuel to this fire.

What action do you take in your own life to maintain a healthy heart?

One thing I try to do is run maybe once or twice a week, although I could probably do more. The diet we have the best evidence for is probably the Mediterranean diet, so I use a lot more olive oil, nuts and healthy fats. That's something that I changed based on my reading of the evidence. But one important factor as far as my risk is concerned is that I'm a south Asian male, and south Asians are at an incredibly high risk for heart disease. That really hasn't been recognised much until recently.

Research has linked endurance sports with an increased risk of atrial fibrillation (AFib), a type of irregular heartbeat that 1 million people in the UK live with. Is there a chance that too much exercise could actually be bad for our hearts?

What we have seen is that it's mostly a J-shaped curve: very little exercise is bad, and there's some evidence that there is such a thing as too much exercise. But I've rarely ever been in a situation where I've asked a patient to reduce the amount of exercise they do. Our challenge is really trying to get people to exercise as much as possible. The benefits of exercise are so widespread.

Do you think totally artificial hearts will ever become a reality?

I think they could. But right now, we have done better with a mechanical pump sewn into the heart, called a left ventricular assist device (LVAD). These patients' experiences are unlike any other human beings who have ever lived. Most of them don't have a pulse. Listening to their chest, you actually hear the pump running. If they run out of batteries, they could die, sometimes instantaneously. But they also represent the dawn of a new age. People have always anticipated that one day, we will be transhuman, but that time has already arrived. Patients who have LVADs, who there are tens of thousands of around the world, are a living example of that.

Heart attacks are often missed in women because they look different from those in men. What can we do to fix that?

One false belief that still persists for many is that heart disease is a man's disease. Women can have later onset of heart disease than men because they do get some protection from female hormones, but really, if you look at the entire span of life, heart disease kills as many women as it does men. Not only do a lot of women not pay attention to their hearts, this is also

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true of clinicians. A lot of times we incorrectly think that women with heart disease may have something else going on. We're better than where we were a few years ago but there's still a long way to go.

Do you foresee a future in which we all wear a heart monitor that will report to our doctors when something irregular starts happening?

The Apple Watch already gets similar information, and there are other devices that are even better at assessing the heart – so this is not just something that's going to happen in the future, it's being vigorously studied now. To me what this represents is the democratisation of the EKG [electrocardiogram]. I think it's going to be very good for many patients. But I also worry it may create a lot of false alarm.

The other thing this highlights, is that heart disease is increasingly becoming a disease of socially disadvantaged people. People who are affluent can afford lifestyles that are healthy, healthier food and access to technologies that can monitor their own health. Heart disease could transform from a medical ailment to an economic ailment, in which just having heart disease becomes a synonym for poverty.

Can you die from a broken heart?

It's possible – but you'd be surprised by what breaks people's hearts. This is a condition called Takotsubo cardiomyopathy, first reported by Japanese cardiologists who were seeing a lot of mostly elderly women coming in after emotional traumas with very weak hearts. The mortality from this condition is the same as that from a heart attack, so it needs to be taken seriously. People traditionally thought that Takotsubo occurred after something like a divorce or the death of a loved one. But any type of emotional overload can increase the risk – even joy. Studies are showing that the most common cause of the syndrome is actually work-related stress. This goes to a wider arc borne out by the data, which is that work-related stress is really one of the drivers of this ongoing epidemic of heart disease.

What do you think the next big medical advance will be when it comes to our hearts?

We already have so many medications that can help you live longer and better. The question is, how can we make sure that all the patients who would benefit from them actually get them and take them? So many patients with high cholesterol are not taking any cholesterol medications. So many patients with heart failure could benefit from simple medications,

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yet they're not taking them. What might define the next few decades is not a breakthrough technology, but thinking about how we can get the advances we already have to patients, not just in the UK or the US, but around the world in places like China, Pakistan and India.

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Do Video Games and Mental Illness Cause Mass Shootings? Here's the Science

2019-08-08

Every time a mass shooting occurs, the country talks about mental health. Many politicians are quick to point to the shooters' disturbed minds. News reporters probe for "loner" tendencies or signs of instability. "Mental illness and hatred pull the trigger. Not the gun," said President Trump on Monday, after two mass shootings in less than 24 hours. So, is mental illness to blame for America's mass shootings? Not according to research. Some mass shooters have a history of schizophrenia or psychosis, but many do not. Most studies of mass shooters have found that only a small fraction have mental health issues. And researchers have noted a host of other factors that are stronger predictors of someone becoming a mass shooter: a strong sense of resentment, desire for infamy, copycat study of other shooters, past domestic violence, narcissism and access to firearms. "It's tempting to try to find one simple solution and point the finger at that," said Jeffrey Swanson, a professor in psychiatry and behavioural sciences at Duke University School of Medicine. "The fact that somebody would go out and massacre a bunch of strangers, that's not the act of a healthy mind, but that doesn't mean they have a mental illness." As mass shootings have become more common in recent years, their connection to mental health has been increasingly scrutinised by the FBI, police departments, forensic psychiatrists, mental illness experts and epidemiologists. In a 2018 report on 63 active shooter assailants, the FBI found that 25 percent had been diagnosed with a mental illness. Of those, three had been diagnosed with a psychotic disorder. In a 2015 study that examined 226 men who committed or tried to commit mass killings, 22 percent could be considered mentally ill. A report from the conservative think tank the Heritage Foundation estimated that a majority of mass shooters have mental illness, based in part on looser definitions and retroactive assessments. Research has long debunked another common explanation among politicians: that violent video games are driving the mass shooting crisis. The idea was floated again by House Minority

The eagerness to blame mental health and video games means society is searching for answers in the wrong places, experts say.

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Leader Kevin McCarthy (R-Calif.) and Trump, who talked of restricting “gruesome and grisly video games.” There is, however, no statistical link between playing violent video games and shooting people, said Jonathan Metzl, director of the Centre for Medicine, Health and Society at Vanderbilt University. A 2004 report conducted by the Secret Service and the Education Department found that 12 percent of perpetrators in more than three dozen school shootings showed an interest in violent video games. Despite a continuing lack of a link, lawmakers and public figures continue to blame the gaming industry. “When politicians like President Trump perpetuate this narrative, to me, it is the height of irresponsibility, because it’s perpetuating a falsehood,” Metzl said. The eagerness to blame mental health and video games means society is searching for answers in the wrong places, experts say. At the height of the reflex to blame video games - following the Columbine High School shooting in 1999 - a Gallup poll found that 62 percent of adults nationwide believed entertainment was the major catalyst for the tragedy and that 83 percent supported restrictions on the sale of violent media to children. President Bill Clinton even called for an investigation on how the advertising industry sold violent entertainment.

Last year, a Post-ABC poll on mass shootings found that 57 percent of people believed shootings were a reflection of failures to identify and treat people with mental health problems. Meanwhile, 28 percent thought it reflected inadequate gun-control laws. “The irony is clearly we do need more robust mental health system,” said Arthur C. Evans Jr., a psychologist who heads the American Psychological Association. “But that’s separate and apart from these shootings.” Almost 5 percent of the US population suffers from a serious mental illness in a health-care system that most clinicians say severely under-prioritises mental health. That has often left those in crisis begging insurers and providers for help. More than 60 percent of counties in America don’t have a single psychiatrist. Only 43 percent of adults in the United States with a mental health condition received help in the past year. People with serious mental disorders are 3.6 times as likely to exhibit violent behaviour, according to the National Epidemiologic Survey on Alcohol and Related Conditions. But they are far more likely to be the victims of violence - at 23 times the risk, compared with the general population. A study published in the journal *Annals of Epidemiology* found that “the large majority of people with mental disorders do not engage in violence against others, and that most violent behaviour is due to factors other than mental illness.” “We like to think that anyone who kills others is somehow mentally ill,” said Phillip Resnick, who served as a forensic psychiatrist in cases including Oklahoma City

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bomber Timothy McVeigh and Unabomber Ted Kaczynski. In an interview last year, Resnick said, "you have to remember, people kill for all sorts of reasons. They kill for profit or love or greed." Mental health advocates say comments such as Trump's labelling shooters as "mentally ill monsters" can exacerbate false stereotypes about the mentally ill. "When you blame people with mental illness for things like mass shootings, it's not just untrue," said Angela Kimball, head of the National Alliance on Mental Illness. "It keeps people from seeking help even when they need it. It spreads unjustified fears about the mentally ill and worsens the stigma around it."

The 2018 FBI study found that shooters typically experienced several stressors in the year before they attack: financial pressures, fights with classmates or co-workers, and substance abuse. And on average, shooters displayed four to five concerning behaviours that those around them could notice - the most frequent being behaviour related to mental health, interpersonal conflicts or some sign of violent intent. Researchers point out that other countries have similar rates of mental illness but a small fraction of America's gun deaths. Similarly, video games are widespread in Europe and Asia, yet their rates of gun deaths are much lower than that in the United States. Epidemiologists say that what sets the United States apart from the rest of the world is guns. America has nearly 400 million civilian-owned firearms, or 120.5 guns per 100 residents - meaning that the country has more guns than it has people. The second-closest country, Yemen, had 52.8 guns per 100 residents, according to the Small Arms Survey. "Mental illness is not the real issue, because mental illness is something that happens across the globe. Mass shootings? Not so much," Kimball said. "The sad truth is that in America, it's easy to get a gun. It's very difficult to get mental health care."

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These 6 Specific Exercises Can Cut Body Weight, Even if You're Predisposed to Obesity

2019-08-08

We know that a range of factors influence weight, including those related to lifestyle and genetics, but researchers have now identified six specific exercises that seem to offer the best chance of keeping your weight down – even if your genes don't want you to. Based on an analysis of 18,424 Han Chinese adults in Taiwan, aged between 30 and 70 years

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old, the best ways of reducing body mass index (BMI) in individuals predisposed to obesity are: regular jogging, mountain climbing, walking, power walking, dancing (to an “international standard”), and lengthy yoga practices. But interestingly, many popular exercise types weren’t shown to do much good for those who’s genetic risk score makes them more likely to be obese. Specifically, exercises including cycling, stretching, swimming and legendary console game Dance Revolution don’t appear to be able to counteract genetic bias (though are beneficial in many other ways). “Our findings show that the genetic effects on obesity measures can be decreased to various extents by performing different kinds of exercise,” write the researchers in their paper published in PLOS Genetics. “The benefits of regular physical exercise are more impactful in subjects who are more predisposed to obesity.” Besides BMI, the team also looked at four other obesity measures for a more complete picture: body fat percentage (BFP), waist circumference (WC), hip circumference (HC), and waist-to-hip ratio (WHR). Regular jogging – 30 minutes, three times a week – turned out to be the most effective way of counteracting obesity genes across all of them. The researchers also suggest, based on the information dug up in the Taiwan BioBank database, that the less effective forms of exercise typically don’t use up as much energy, which is why they don’t work quite so well. The researchers specifically noted that activities in cold water, such as swimming, could make people hungrier and cause them to eat more. The study was able to succeed in one of its main aims, which was to show that having a genetic disposition towards obesity doesn’t mean that obesity is inevitable – the right type of exercise, carried out regularly, can fight back against that built-in genetic coding. “Obesity is caused by genetics, lifestyle factors, and the interplay between them,” epidemiologist Wan-Yu Lin, from the National Taiwan University, told Newsweek. “While hereditary materials are inborn, lifestyle factors can be determined by oneself.” It’s worth noting that not every type of exercise was popular enough within the sample population to be included: activities like weight training, table tennis, badminton or basketball may or may not be helpful, too. There wasn’t enough data to assess. But with obesity numbers rising sharply across the world – and 13 percent of the global population now thought to qualify as being obese – it’s clear that measures need to be taken to reverse the trend. Being obese affects our physiological health in the way it increases the risk of cardiovascular disease, some cancers, and other issues; and there’s evidence that being seriously overweight can have a negative effect on our brains too. Studies like this latest one can point towards ways of sticking at a healthy weight, even when the genetic cards are stacked against it. In some cases, all it takes is a few minutes of exertion per day. “Previous studies have found that performing regular

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physical exercise could blunt the genetic effects on BMI," conclude the researchers. "However, few studies have investigated BFP or measures of central obesity. These obesity measures are even more relevant to health than BMI." The research has been published in PLOS Genetics.

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Artificial tongue could taste whisky to make sure it isn't counterfeit

2019-08-08

An artificial tongue can taste subtle differences between drams of whisky and could one day help tackle the counterfeit alcohol trade. The technology is capable of picking up on the differences between the same brand aged in different barrels, with more than 99 per cent accuracy and can tell the difference between those aged for 12, 15 and 18 years. "We call this an artificial tongue because it acts similarly to a human tongue – like us, it can't identify the individual chemicals which make coffee taste different to apple juice but it can easily tell the difference between these complex chemical mixtures," says Alasdair Clark at the University of Glasgow. The tongue has two different types of metal tastebuds, which provide more information about each sample and allows a faster and more accurate response. Once liquid is poured over the metals, measuring how they absorb light reveals some of its properties. Clark and his colleagues used the tongue to sample a selection of whiskies from Glenfiddich, Glen Marnoch and Laphroaig. "While we've focused on whisky in this experiment, the artificial tongue could easily be used to 'taste' virtually any liquid, which means it could be used for a wide variety of applications," says Clark. As well as counterfeiting, it could be used in food safety testing and quality control. Other techniques exist for analysing liquids. The most common involves analysing the weights of the constituent molecules. Another synthetic tongue developed in 2017 uses 22 different fluorescent dyes and analyses how they affect a liquid's brightness.

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An artificial tongue can taste subtle differences between drams of whisky and could one day help tackle the counterfeit alcohol trade.

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Key labour union, environmental groups want Notre-Dame site sealed over lead fears

2019-08-08

A top French labour union and environmental health groups have banded together to demand Notre-Dame Cathedral be covered and sealed after the fire that destroyed its roof, deeming it an ongoing source of lead pollution. The April 15 blaze that destroyed the cathedral's spire and its roof also melted massive quantities of lead, toxic dust from which was dispersed into the air in the French capital and deposited on the ground. "The 440 tonnes of lead that went up in smoke during the fire represent more than four times the annual lead emissions in the atmosphere for all of France," Annie Thébaud-Mony, a researcher and spokeswoman for the environmental health group Association Henri Pézerat, told reporters on the square in front of the heavily damaged cathedral. Families of tourists could be seen, surreally, snapping souvenir photos on the square, apparently oblivious to the press conference under way that was discussing the toxic dust embedded in the pavement underfoot. Thébaud-Mony's association, alongside the CGT labour union and the Association for the Families of Victims of Lead Poisoning, wants to see the 850-year-old monument sealed off. The containment process would entail enveloping the building in its entirety – including its iconic twin towers – in airtight plastic sheeting draped over a giant metal scaffolding. Slightly dropping the air pressure within the cathedral-sized tent would then work to keep lead particles from leaking outside while the site's interior is fully decontaminated, the groups say. The same technique was used at a nearby Sorbonne campus, across the Seine in Paris's fifth arrondissement (district), while the university was being cleansed of asbestos. "It's the only way," Thébaud-Mony said of obscuring the familiar stone belltowers with sheeting. "The whole building was completely caught up in the fire, in the smoke, and so surely there is lead dust in all of the sculptures, et cetera." She said variations in the lead-level readings taken around the cathedral show occasional peaks of pollution that suggest the site continues to release toxic dust. "There has necessarily been some re-release [of particles] with activity on the site, activity in the street and the wind." Fears of lead contamination around the cathedral and well beyond its central Paris home on the Île de la Cité have grown as lead readings taken since April are gradually made public.

Schools closed

At the end of July, two schools in the sixth arrondissement southwest of the cathedral – and therefore downwind of the blaze on the night of

A top French labour union and environmental health groups have banded together to demand Notre-Dame Cathedral be covered and sealed after the fire that destroyed its roof, deeming it an ongoing source of lead pollution.

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April 15 – were shuttered over lead fears. The kindergarten and primary school on the rue Saint-Benoît – a side street around the corner from Saint-Germain-des-Prés' famed Café de Flore – were closed down after readings showed levels of lead contamination above 7,000 micrograms per square metre, 100 times the 70-microgramme-per-square-metre threshold above which taking action is advised. Experts say there is no safe level of exposure to lead, which is a neurotoxin. Young children, and their developing nervous systems, are particularly vulnerable. "The big problem is that, when you don't seek out how much lead is in the blood, you don't find it – because lead is insidious," Mathé Toullier, of the Association for the Families of Victims of Lead Poisoning, said Monday. "You can't see it; you can't feel it; it doesn't initially present patent signs." But lead's noxious effects on children's intellectual capacity, male fertility and pregnancy are well known, she said. After lingering in the bloodstream, Toullier explained, lead is stored in the bones for decades, with the potential of being leached back into the bloodstream during, for instance, a pregnancy. "When it comes out again during pregnancy, that's it, the baby risks being contaminated and it goes to the subsequent generation." Toullier noted that workers were seen toiling at Notre-Dame without protective face masks. "We're the ones informing the workers here [at Notre-Dame] of what to do," Toullier said of her association. "Don't bring shoes or work uniforms home' to avoid the risk of bringing home all the dust, to protect the children. It's pretty absurd."

Work suspended

Indeed, on July 25, the work site at the cathedral was suspended over lead concerns. Health and safety authorities reported that decontamination practices at the site were insufficient for the job at hand and that precautions were not being applied systematically. The regional prefecture announced on Friday that work would resume gradually after new decontamination units are installed next week, but the CGT union says that timeline is too short to guarantee workers' safety. "There is a source of pollution here, alas, it's Notre Dame. It needs to be contained, the entirety of the building, to prevent it from continuing this pollution," Benoît Martin, who heads the CGT union for Paris, told reporters in the shadow of the cathedral. The union leader catalogued a long list of workers potentially affected by Notre-Dame lead contamination who, he said, should consider submitting to blood-lead tests. They include not only the workers directly tending to rebuilding Notre-Dame but also the police officers at the prefecture across the street and guarding the monument; employees of the Hôtel-Dieu hospital across the square; the

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more than 400 firefighters who tamed the blaze on April 15; journalists who covered the blaze; street cleaners; garbage collectors; staff at neighbouring schools, crèches, cafés, restaurants and souvenir shops; as well as the bouquinistes who tend the bookstalls on the Seine's riverside quays. Martin said public emotion and political pressure in the aftermath of the inferno was, perhaps understandably, focused on donations and reconstruction. French President Emmanuel Macron stirred controversy when he pledged the ambitious reconstruction timeline of five years, suggesting France's erstwhile most-visited tourist attraction could reopen as early as 2024 – the year Paris is set to host the summer Olympic Games. But Martin said the priority, as soon as the embers cooled, should have been decontamination. "If the calendar for Notre-Dame's reconstruction is delayed a few months, that isn't a problem to us," Martin said. "What's important to us isn't the calendar some people want to go quickly. One has to take the time to treat the problems one after the other: contain, decontaminate, rebuild."

New readings due

The collective of labour representatives and environmental groups is also demanding that lead contamination measurements be mapped rigorously and updated regularly. Furthermore, it wants the Hôtel Dieu hospital to become a monitoring centre for residents and workers affected by the lead pollution, one providing support over the long term and centralising information on the patients contaminated. After sounding the alarm over possible lead contamination and condemning a lack of information disseminated in the wake of the disaster, the environmental activist group Robin des Bois last week filed a lawsuit accusing authorities of deliberately imperilling people's health and failing to assist those endangered by lead pollution from Notre-Dame. The City of Paris has published a series of documents and lead measurement data from some of the schools neighbouring Notre-Dame on its website. It is due to release new lead pollution readings on Tuesday.

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Scientists Have Found a Way to Better Predict Where Volcanoes Will Erupt Next

2019-08-08

Not every volcanic eruption is a Mount Vesuvius-like catastrophe, with rivers of fire and flying rock that rains down on unsuspecting Pompeiians. Sometimes, volcanoes' summits collapse, forming miles-wide depressions called calderas, which are peppered by eruptive vents. When rivulets of magma force their way out of these vents, those small eruptions can spew dangerous amounts of lava and gas. But the locations and threat levels of these vents are difficult to predict – eruptions can sometimes occur miles from the caldera's centre. That leaves cities located on or near volcanic fields, like Naples, Italy, facing a constant risk of poisonous volcanic gas, ash, and explosive bursts of lava. Now, however, a group of scientists have figured out how to accurately pinpoint where on a volcano's surface or in a caldera's volcanic fields these damaging vent eruptions are likely to occur. "Calderas have fed some of the most catastrophic eruptions on Earth and are extremely hazardous," the scientists wrote in a new study published in the journal *Science Advances*. That hazard is often underestimated by local populations, they added. Mount Kilauea in Hawaii, which erupted last year, is speckled with such vents. The eruptions forced nearly 1,500 people to flee their homes, CBS News reported. "These vents have lava coming out of them like fountains, which then leaks across the landscape like a slug," Eleonora Rivalta, the lead author of the study, told *Business Insider*. The scientists hope that insights from their new model could help communities like Hawaii's better prepare for and anticipate future eruptions.

Magma's fickle pathways

Magma, the liquid or semi-liquid rock under the Earth's crust, makes up most of our planet's mantle (its intermediary layer). When magma pushes its way to the surface, that causes a volcanic eruption. Magma likes to take the path of least resistance as it surges upward. So, figuring out what that path is can enable scientists to predict where it will next breach our planet's surface. That's what Rivalta's team set out to do. The easiest path, the researchers found, is for magma to move through rocks that are more "stretched out" than their nearby counterparts – less compressed, in other words. Although many geologists thought the path of least resistance would be through an existing pathway or fault, Rivalta's team found that vents are often "single-use only", meaning magma erupts through them once and never again. Rivalta and her colleagues used these discoveries to make computer models of future magma paths to the surface. They

Not every volcanic eruption is a Mount Vesuvius-like catastrophe, with rivers of fire and flying rock that rains down on unsuspecting Pompeiians.

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compared the predictions of their model to the known eruptive behaviour of vents across Italy's Campi Fleigrei, outside of Naples. This 8-mile-wide active volcanic field – known as the “burning fields” – first erupted almost 50,000 years ago, though the most recent major eruption was in 1538. Rivalta's model accurately mapped Campi Flegrei's 70 eruptions over the past 15,000 years, including the highly damaging Monte Nuovo eruption in 1538.

Predicting the next Yellowstone eruption

Between 1600 and 2017, 278,880 people around the world were killed by volcanic activity and the consequences of those eruptions, like starvation or tsunamis. Since the 1980s, deaths related to volcanic eruptions have been rather limited, as geographer Matthew Blackett reported in *The Conversation*. This isn't because scientists have gotten better at predicting eruptions – it's a matter of chance, since recent eruptions have been far from heavily populated areas. So, Rivalta hopes to leverage her group's new research to give cities like Naples more information about impending eruptions. She also wants to apply this new model to Mount Etna in Sicily, and use it to examine the supervolcano under Yellowstone National Park. That enormous volcano last erupted more than 640,000 years ago. If it were to erupt again, the supervolcano would spew ash across thousands of miles of the US. Following the Yellowstone volcano's last eruption, it collapsed on itself, creating a 1,500-square-mile caldera that's ripe for new appearances of magma. “Yellowstone is a caldera with tons and tons of vents,” Rivalta said. “The question of where the next one might appear is very relevant to this caldera.”

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Coke and Pepsi abandon the plastics lobby

2019-08-08

Coca-Cola and PepsiCo, two major sellers of plastic bottles, have made sweeping sustainability commitments. Now they are stepping away from a plastics lobbying group. Both soft drink companies are trying to increase the amount of recycled plastic they use in bottles. They want to improve recycling infrastructure and ensure their packages are recyclable. But the Plastics Industry Association has ties to the American Progressive Bag Alliance, which encourages states to make plastic bans illegal. Participation in the association could tarnish Coca-Cola and Pepsi's images as companies working to find solutions to plastic pollution.

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The association took positions that “were not fully consistent with our commitments and goals,” Coca-Cola said in a statement last week, noting that it withdrew from the group earlier this year. Pepsi said it had joined the association to learn about innovation as it works to “achieve a circular economy for plastics.”

“We do not participate in the policy advocacy work of the association or its subsidiaries, and our membership will conclude at the end of this year,” Pepsi said. Coke and Pepsi “made the wrong choice” by being a part of the lobbying organisation, said Dianna Cohen, CEO of the non-profit Plastic Pollution Coalition. The optics of membership, she added, “are really bad.” Cutting ties with the Plastic Industry Association is a sign that “companies understand that they cannot publicly say they want to end plastic pollution, while financially supporting an association that lobbies for our continued reliance on throwaway plastics,” said Greenpeace USA Oceans Campaign Director John Hocevar in a statement. The move may help reassure some customers. But as people grow more worried about the negative impacts of plastic pollution on the environment as well as on animal and human health, companies like Pepsi and Coke will have to go even further to find a solution.

Tackling plastic pollution

Coca-Cola (KO) produced 3.3 million tons of plastic in 2017, it disclosed in recent report by the Ellen MacArthur foundation. PepsiCo (PEP) did not disclose how much plastic it sells. Both companies are trying to figure out ways to reduce their use of virgin plastics and increase recycling. They’re also exploring alternatives to plastics, like aluminium, that are easier to recycle. PepsiCo announced recently that its Aquafina-brand water will be sold in aluminium cans at US fast food and restaurant chains as soon as next year. The company is testing out a broader rollout to retail stores. Coca-Cola promised to help fix recycling. “Tackling plastic waste is one of my top priorities and I take this challenge personally,” PepsiCo CEO Ramon Laguarta said at the time. “We are doing our part to address the issue head on by reducing, recycling and reinventing our packaging.” Pepsi has committed to using only recyclable, compostable or biodegradable packaging by 2025, and it’s pledged to make new plastic bottles using 25% recycled material. Plus, Coca-Cola last year launched a World Without Waste initiative that encompasses its recycling goals, which include collecting and recycling the equivalent of every bottle or can it sell by 2030. The company has also committed to making its bottles and cans out of at least 50% recycled material in the next 11 years. Still, sticking to those goals will likely be difficult, especially because recycling is struggling.

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Organisations like the World Wildlife Fund are helping companies try to achieve them. The companies are also exploring refill stations that eliminate single-use packaging altogether. Pepsi is selling a high-tech water cooler that lets customers fill up their own bottles with flavoured or unflavoured, still or carbonated water in varying temperatures. Coca-Cola has launched a similar product for Dasani on college campuses.

Leaving the lobby

Those initiatives made membership in the plastics trade group problematic, at least from a PR standpoint. The Plastics Industry Association is not only a lobbying group. Some of its initiatives, like helping recycling, may overlap with those of Coke and Pepsi. "Our members work together to align their efforts to put recycling and sustainability at the forefront of their businesses," said Patty Long, interim president and CEO of the Plastics Industry Association, in a statement. The plastics association says it does not itself lobby for legislation that bans plastic or hold an official position on those laws. It says that it operates separately from the bag alliance and has different memberships and dues. But a page on the association's website redirects to the bag alliance site, and the contact email for the bag alliance has the same suffix as the association's. An association representative declined to share how the groups are connected. Activists started pressuring Coke, Pepsi, and other companies to leave the plastic association last year. The shareholder activist group As You Sow and Walden Asset Management called attention last year to corporate involvement with the Plastic Industry Association, and wrote letters to the CEOs of Coca-Cola and PepsiCo, among others. This year, Greenpeace also drew a line between the Plastic Industry Association and anti-plastic ban laws. The plastics association said Greenpeace is responsible for companies' withdrawal from the group. "We are aware that several prominent brands that are members of the association have been targeted by a persistent Greenpeace activist campaign to pressure them to leave our association," Long said, calling the efforts "unfortunate."

CNN News, 5 August 2019

<http://www.cnn.com/health>

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