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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

Cancellation of Product Label Approvals at the Request of the Holder

2019-04-26

At the request of the holder, the Australian Pesticides and Veterinary Medicine Authority (APVMA) has cancelled the product label approvals for Antracol Fungicide Spray. Details as follows:

Product no.	Product name	Registrant	Product label approval number	Date of effect
30613	Antracol Fungicide Spray	Bayer Cropscience Pty Ltd	30613/1202	14 December 2018

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

SUPPLY

A person may supply or cause to be supplied the above product(s) bearing the cancelled label manufactured prior to 14 December 2018 at wholesale and retail level, until 14 December 2019. After 14 December 2019 it will be an offence against the Agvet Codes to have possession or custody of the product(s) bearing the cancelled label with the intention to supply, or to supply the product.

USE

A person may continue to use the product(s) bearing the cancelled label according to its label instructions until 14 December 2019. Any person who possesses, has custody of, uses, or otherwise deals with the listed product bearing the cancelled label in accordance with the above instructions is taken to have been issued with a permit under the Agvet Codes to so possess, have custody of, use or otherwise deal with the product(s) bearing the cancelled label until 14 December 2019. The supply and use of the product(s) bearing the cancelled label must be in accordance with the conditions of registration or approval, including any conditions relating to the shelf life or expiry date. It is an offence to possess, have custody of, use, or deal with the product(s) bearing the

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cancelled label listed in the table in a manner that contravenes the above instructions.

APVMA Chemical Gazette, 23 April 2019

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

Labelling changes: information for health professionals

2019-04-26

Quality Use of Medicines relies on clear medicine labels. To reduce medication errors, medicine labels need to be more consistent, with important information made more prominent and easier to read.

The Therapeutic Goods Administration (TGA) has introduced improvements to help bring Australian medicine labels up to date and align them with international best practice. They will help Australians to make more informed choices about their medicines and to use them more safely.

Posters

We have developed posters targeted at healthcare professionals and consumers. These will be gradually released over the 4-year transition period. The healthcare professional's poster is a quick reference guide for health professionals highlighting some of the key medicine labelling changes that are important for consumers. You can help by displaying this poster in staff areas and speaking with consumers about the changes that affect them. A copy of the poster is available at: [Your medicine, your knowledge - Improved medicine labels \(pdf,369kb\)](#). The consumers poster aim to raise awareness of the labelling improvements. A copy of this poster is available at: [Your medicine, your knowledge - Medicine labels are improving \(pdf,235kb\)](#) and [Your medicine, your knowledge - Medicine labels are improving \(pdf,369kb\)](#).

Updated medicine ingredient names

Australian medicine ingredient names are changing to align with names used internationally. Most are minor changes. More significant changes will continue to use both the old and new name on the label for a period. Posters and leaflets to help raise awareness of these ingredient name changes are available to download and print. More information is available

The Therapeutic Goods Administration (TGA) has introduced improvements to help bring Australian medicine labels up to date and align them with international best practice.

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at: [list of affected ingredients](#) and [Updating medicine ingredient names](#) page on the TGA website.

TGA, 23 April 2019

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

New Environment Protection Act explained at Traralgon Open House

2019-04-26

Businesses in Environment Protection Authority Victoria's (EPA) Gippsland area are being invited to hear how the new Environment Protection Act will affect them at an Open House in Traralgon. The new Act emphasises the need to prevent pollution occurring, but still gives EPA, as the regulator, significant deterrents including fines up to \$1.6 million for breaches. Reckless and deliberate acts that cause pollution could lead to fines of up to \$3.2m and possible jail for individuals. Businesses, as well as individuals, in the area will be covered by the new laws from 1 July 2020. EPA will be proactively engaging with businesses so they know what they have to do to be compliant, and the benefits that being compliant bring. "The region has faced environmental challenges including dust and odour, as well as sewage spills and pollution events in our creeks and waterways. EPA officers are often called because of pollution incidents and the Gippsland public are very good at maintaining a watchful eye," said Stephen Lansdell EPA Regional Manager Gippsland Region. "This Act will help us prevent those and other kinds of pollution challenges. While there are businesses that wilfully ignore their obligation to protect the environment, many simply don't understand what they have to do to be compliant with it. "Ignorance is not a defence and from July 2020 offenders could face large fines if they cause pollution and harm the environment or the community. "If business is not compliant, they should know the potential penalties can be extremely costly, and as the Act gives wider powers, there's a much greater chance of detection leading to an EPA sanction." EPA is planning events throughout the lead up to the implementation of the new laws and as a first step, the Authority is holding a series of open houses for local businesses and community members to come along and discuss the new Act and how it affects businesses. The *Environment Protection Amendment Act 2018* provides the foundation for a transformation of Victoria's environment protection laws and Environment Protection Authority Victoria (EPA). The Victorian Government intends this new legislation to take effect from 1 July 2020. It includes a new approach to environmental issues, focusing on preventing

The new Act emphasises the need to prevent pollution occurring, but still gives EPA, as the regulator, significant deterrents including fines up to \$1.6 million for breaches.

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waste and pollution impacts rather than managing those impacts after they have occurred. The legislation will enhance the protection of Victoria's environment and human health through a more proportionate, risk-based environment protection framework that includes:

- A preventative approach through a general environmental duty.
- A tiered system of EPA permissions to support risk based and proportionate regulatory oversight.
- Significant reforms to contaminated land and waste management.
- Increased maximum penalties.
- Requirements for more environmental information to be publicly available.
- Modernising and strengthening EPA's compliance and enforcement powers.

You can view the Act at the [Victorian Parliament's website](#).

Further information is available at: [Fact sheet: Environment Protection Amendment Act 2018](#)

EPA Victoria, 23 April 2019

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

South Korea to Update Existing Chemical Inventory

2019-04-26

On 10 April 2019, South Korea's Ministry of Environment (MoE) published a consultation on the updates to the Existing Chemical Inventory (KECI) by MoE Notice No. 2019-214. South Korea's Existing Chemical Inventory consists of two parts:

- Annex 1 of 37,088 chemical substances domestically circulated in Korea prior to Feb 2nd, 1991; and
- Annex 2 of 7,390 chemical substances published by MoE after hazard evaluation under TCCA after 2 Feb 1991.

The proposed updates to KECI include:

- Adding 1 substance (KE-35662) into Annex 1
- Updating chemical name of three substances (KE-03386, KE-08677, KE-34673) in Annex 1
- Deleting 5 non-toxic substances (KE No. 2015-3-6230, 2015-3-6253, 2015-3-6257, 2015-3-6258, 2015-3-6460) from Annex 2

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- Adding 2 substances (given KE No. 2019-3-7260, 2019-3-7261) into Annex 2
- Disclosing the chemical name of 304 substances (They previously applied for confidential information protection with only generic names and the validity for data protection has expired) in Annex 2

The details are accessible [here](#):

Chemlinked, 18 April 2019

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

Thailand Invites Public Comments on Proposed Amendment to the List of Hazardous Substances

2019-04-26

Thailand's Department of Industrial Works published a draft amendment to the List of Hazardous Substances. Six agencies maintain and periodically update their respective annex of the List of Hazardous Substances, which are:

1. Annex 1 – Department of Agriculture (DOA);
2. Annex 2 – Department of Fisheries (DOF);
3. Annex 3 – Department of Livestock Development (DOLD);
4. Annex 4 – Food and Drug Administration (FDA);
5. Annex 5 – Department of Industrial Works (DIW); and
6. Annex 6 – Department of Energy Business

If passed, Annexes 4 and 5 will be affected by the proposal. The tables below summarise the changes.

FDA's List of Hazardous Substances:

CAS No.	Name	Remark
2921-88-2	Chlorpyrifos	Prohibited in products used for pest control of insects and other animals

Thailand's Department of Industrial Works published a draft amendment to the List of Hazardous Substances.

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CAS No.	Name	Remark
77-92-9 5949-29-1	Citric acid	New – Type 1 Hazardous Substance in cleaning products and de-clogging of drainage system and sewer line products New – Type 2 Hazardous Substance in disinfectants
50-21-5 79-33-4 598-82-3 10326-41-7	Lactic acid	New – Type 1 Hazardous Substance in cleaning products and de-clogging of drainage system and sewer line products New – Type 2 Hazardous Substance in disinfectants
N/A	Amphoteric surfactants	Type 1 Hazardous Substance in cleaning products and de-clogging of drainage system and sewer line products
N/A	Amine oxides	New – Type 1 Hazardous Substance in cleaning products and de-clogging of drainage system and sewer line products

DIW's List of Hazardous Substances:

CAS No.	Name	Remark
625-45-6	Methoxyacetic acid	Permit up to 0.3% w/w, as an impurity, in a product
118-74-1	Hexachlorobenzene	Permit up to 0.005% w/w, as an impurity, in a product
1163-19-5	Decabromodiphenyl ether	New – Type 3 Hazardous Substance
68920-70-7	Alkanes, C6-C8, chloro	New – Type 3 Hazardous Substance

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CAS No.	Name	Remark
108171-26-2	Alkanes, C10-C12, chloro	New – Type 3 Hazardous Substance
85535-84-8	Alkanes, C10-C13, chloro	New – Type 3 Hazardous Substance
85681-73-8	Alkanes, C10-C14, chloro	New – Type 3 Hazardous Substance
71011-12-6	Alkanes, C12-C13, chloro	New – Type 3 Hazardous Substance
85536-22-7	Alkanes, C12-C14, chloro	New – Type 3 Hazardous Substance

The DIW is currently accepting public comments in regard to the proposed amendment. The comment period is ongoing, and the agency has not announced the final day of the period. Further information is available (in Thai) at:

[Draft Amendment on List of Hazardous Substances](#)

Product Supply Chain Intelligence, 1 April 2019

<https://psi.ul.com>

AMERICA

Washington state targets toxic chemicals

2019-04-26

Washington state has passed a bill to regulate toxic chemicals in consumer products that threaten people and endangered orcas. Lawmakers in the state of Washington have cleared a bill aimed at protecting people and wildlife from toxic chemicals in consumer products. The legislation, which Gov. Jay Inslee (D) is expected to sign, requires state agencies to identify and regulate classes of chemicals that pose a health risk to sensitive populations such as pregnant women and children and endangered species like orcas. "The same toxic chemicals found in our homes and bodies are also found in wastewater, storm water, sediments, and fish and wildlife," Mindy Roberts, director of the Puget Sound Program at the Washington Environmental Council, an advocacy group, says in a statement. "While orcas do not use consumer products like TVs, chemicals from these products build up in our indoor environments and eventually make their way into the outdoor environment." The bill targets

Legislature passes bill to protect people, wildlife from harmful substances

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several chemical classes, including phthalates, per- and polyfluoroalkyl substances, polychlorinated biphenyls, alkylphenol ethoxylates, bisphenols, and organohalogen flame retardants. It gives the Washington State Department of Ecology authority to ban such chemicals in consumer products if the agency determines that safer alternatives are available. "Washington state is leading the way, showing other states and the nation how to protect communities and the environment from toxic threats," says Sarah Doll, national director of *Safer States*, a network of environmental health advocacy groups. "This victory is especially important given that the federal administration is failing to protect the health of people and the environment from harmful chemicals." An overhaul of the Toxic Substances Control Act (TSCA) in 2016 gave the US Environmental Protection Agency new authorities to regulate toxic chemicals. Chemical manufacturers supported TSCA reform to stop states from creating a patchwork of different chemical laws. Environmental groups claim that the EPA is not using those authorities, so states like Washington are taking matters into their own hands, creating the very laws that chemical manufacturers fought to stop. "By establishing a stronger, robust federal chemical regulatory program, the 2016 amendments to TSCA provide important regulatory certainty to the business community," the American Chemistry Council, which represents chemical manufacturers, says in an emailed statement. TSCA reform also "relieves state governments of the need to invest significant resources in the complex job of regulating chemicals," the group says.

Chemical & Engineering News, 24 April 2019

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

EPA Issues Guidance on Clean Water Act Permitting Requirements

2019-04-26

The United States Environmental Protection Agency (EPA) issued guidance clarifying the application of Clean Water Act (CWA or the Act) permitting requirements to groundwater. EPA's Interpretative Statement concludes that Congress excluded releases of pollutants to groundwater from the Act's permitting requirements and instead left regulation of those releases to the states and EPA's other statutory authorities. Consistent with Congress' vision for a strong federal state partnership to protect the country's groundwater resources, the agency's new guidance recognises the state's leadership role in protecting groundwater and provides certainty to states and others who implement and enforce EPA's federal

EPA's Interpretative Statement provides certainty to states and the regulated community while recognising long-standing protections for America's groundwater.

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permitting programs. EPA's Interpretative Statement will help inform federal and state regulators with future National Pollutant Discharge Elimination System (NPDES) permitting and enforcement decisions. States should continue to take an active role in regulating discharges to waters within their jurisdictions, as provided in state law and envisioned under the CWA. EPA will continue fulfilling its role in protecting groundwater and hydrologically connected surface waters as authorized by Congress through the Safe Drinking Water Act, the Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act. Recent conflicting federal court decisions and the prior lack of clear agency guidance regarding whether NPDES permits are required for releases of pollutants to groundwater has caused uncertainty regarding how the agency and states should implement and enforce the NPDES permitting program. In February 2018, EPA requested public comment on whether the agency should revise or clarify its position on the issue. At the same time, the agency also undertook a comprehensive review of prior agency statements on the matter and performed a holistic analysis of the text, structure, and legislative history of the Act. Based on this analysis and careful consideration of public input, EPA concluded that Congress excluded releases of pollutants to groundwater from the Act's permitting requirements, regardless of whether there is a hydrological connection between the groundwater and a water of the United States. In conjunction with issuing its Interpretative Statement, the agency is seeking additional public input regarding what may be needed to provide further clarity and regulatory certainty on this issue. The comment period will be open for 45 days after the Interpretative Statement is published in the Federal Register. For more information visit <https://www.epa.gov/npdes/releases-point-source-groundwater>.

U.S EPA, 156 April 2019

<http://www.epa.gov>

US EPA restricts some asbestos products

2019-04-26

The use of asbestos-containing products that are discontinued in the United States, such as building materials reinforced with the mineral, will be more difficult under a new Environmental Protection Agency rule. The action, announced April 17, does not affect ongoing uses of the carcinogenic material, including asbestos diaphragms installed and periodically replaced in some US chlor-alkali manufacturing plants. The rule also falls far short of health and environmental activists' call for the

Not a ban, rule would require agency review before use

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EPA to ban all asbestos products. Instead, the new rule requires any company that wants to reintroduce a discontinued asbestos product to the US market to notify the EPA. The agency will then evaluate the planned uses of the product to determine whether they are safe for human health and the environment. As needed, the EPA will prohibit the products or place restrictions on them before approving their use. The rule will “close the door on certain asbestos products to prevent them from returning to the marketplace without EPA’s review,” says Alexandra Dapolito Dunn, head of the EPA’s Office of Chemical Safety and Pollution Prevention. But Linda Reinstein of the Asbestos Disease Awareness Organization calls the rule “toothless” because it leaves the door open for companies to resurrect obsolete uses of asbestos in the US.

Chemical & Engineering News, 18 April 2019

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

US EPA Finalises Rule Employing “SNUR-Only” Approach for TSCA New Chemical Reviews

2019-04-26

On 5 April 2019, the United States Environmental Protection Agency (EPA) finalised significant new use rules (SNURs) for 13 new chemical substances under section 5(a)(2) of the Toxic Substances Control Act (TSCA). Notably, the 13 chemicals are not also subject to orders under TSCA section 5(e) or 5(f) – an approach that differs substantially from US EPA’s long-standing past practice. US EPA previously outlined this “SNUR-only” strategy in a “framework” policy document in late 2017 that was challenged in a lawsuit. As discussed below, while the lawsuit was withdrawn without court review, the 5 April 2019 final rule revives the framework’s approach, making it likely that US EPA will again face legal challenges related to the issuance of SNURs without enforcement orders. Under the TSCA New Chemicals Review Process, a prospective manufacturer (or importer) of a chemical substance must submit a premanufacture notice (PMN) to US EPA before the substance can be manufactured, imported or processed in the United States. The PMN must describe the chemical substance and the substance’s intended conditions of use. US EPA then reviews the PMN and must determine that the chemical is “not likely to present an unreasonable risk of harm” under its intended conditions of use in order for it to be manufactured, imported or processed in the US. Historically, if US EPA concluded that a certain use of a substance is not likely to present an unreasonable risk of harm but that another use might, the Agency would enter into a TSCA section 5(e) consent order with the PMN submitter that

On 5 April 2019, the United States Environmental Protection Agency (EPA) finalised significant new use rules (SNURs) for 13 new chemical substances under section 5(a)(2) of the Toxic Substances Control Act (TSCA).

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would restrict the other use and then also issue a SNUR for the substance. The SNUR identifies the use of concern as a “significant new use” for the substance, and once the SNUR is in place, a party must submit a Significant New Use Notice (SNUN) to US EPA before manufacturing, importing or processing the substance for that use. When reviewing the PMNs for the 13 chemicals, US EPA made “not likely” determinations for the intended uses identified in the PMNs. In contrast to the past practice, however, while other uses raised concerns, US EPA did not enter into a consent order (or issue a section 5(f) order) for any of the 13 chemicals. Instead, US EPA concluded that a SNUR alone would be adequate in each case because the use of concern was not likely to commence before the SNUR was finalised. As noted, the 5 April final rule is not the first time US EPA introduced the idea of a SNUR-only process for determinations on new chemicals. US EPA broached the SNUR-only approach in the “New Chemicals Decision-Making Framework” issued in late 2017. US EPA indicated that SNURs would “generally be effective vehicles to address such concerns and that, as a general matter, EPA will address such concerns through SNURs.” In January 2018, the Natural Resources Defence Council (NRDC) filed a petition for review of the “New Chemicals Decision-Making Framework” in the Second Circuit Court of Appeals. Environmental and industry groups joined the litigation as amici and intervenors. The NRDC argued that the framework improperly limited US EPA’s review of new chemicals to the intended conditions of use specified in the PMN and disregarded the Agency’s congressional mandate to address risk concerns through enforceable orders. Because the NRDC withdrew the suit after US EPA indicated that it was considering abandoning the framework, there was no judicial consideration of the legality of US EPA’s SNUR-only approach. The April 5, 2019 final rule indicates US EPA intends to go forward with the SNUR-only approach. This could lead to a legal challenge reviving previous arguments about the proper scope of the Agency’s review of new chemical substances under TSCA and whether the SNUR-only approach is lawful.

National Law Review, 22 April 2019

<http://www.natlawreview.com>

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EUROPE

Endocrine disruptors drop the curtain on this European Parliament

2019-04-26

On 18 April 2019, the European Parliament adopted a non-binding resolution asking the European Commission to ensure a higher level of protection against endocrine disruptors (EDCs) by making a legislative proposal on the matter no later than June 2020. It passed with 447 votes in favour, 14 against and 41 abstentions, and was actually the last text to be dealt with by this Parliament. MEPs proposed treating EDCs or potential EDCs on an equal footing with substances classified as carcinogenic, mutagenic or toxic for reproduction, the so-called CMR substances prohibited in EU cosmetics legislation. EDCs are a class of chemicals commonly found throughout our environment in children's products, food containers, personal care products, pesticides and furniture. These hazardous substances alter the functioning of the hormonal system, having a negative effect on the health of humans and animals. Close to 800 chemicals are known or suspected to be capable of interfering with hormone receptors, hormone synthesis or hormone conversion, according to a report drafted in 2012 by the United Nations Environment Programme (UNEP) and the World Health Organisation (WHO). The EU started discussing the issue as early as 1996 and recognised EDCs as a health and environmental hazard in its "Community Strategy for endocrine disruptors" adopted by the Commission in December 1999. The EU executive revamped interest in the topic last November publishing a new strategy for endocrine disruptors and launching a comprehensive screening of the legislation applicable to EDCs through a fitness check. According to the lawmakers, the response is so far not adequate to the health threat, as the EU framework for EDCs suggested by the Commission in November lacks both a concrete action plan to minimise exposure to EDCs and a timeline for the next steps to move forward.

Plenary debate

Representing the EU executive before the plenary, Violeta Bulc defended the EU efforts: "We can be proud of the progress we have achieved since then; we are recognised as one of the global leaders in dealing with these substances." "However, this is not enough: EDCs remain today a global challenge and a source of concern for many citizens," she said. She added that the Commission adopted its communication in November in order

On 18 April 2019, the European Parliament adopted a non-binding resolution asking the European Commission to ensure a higher level of protection against endocrine disruptors (EDCs) by making a legislative proposal on the matter no later than June 2020.

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to step up the EU approach and that the cross-cutting fitness check should be finalised in the first half of 2020, followed by a 12-week-long public consultation. Before the end of the year, the Commission will also organise the first annual meeting of stakeholders and the launch of a new web portal, as part of the comprehensive set of actions to achieve the objectives included in the communication. Although the resolution was backed by all the political groups within the Parliament, the European People's Party (EPP) criticised a sort of "ideological hysteria" on EDCs and, in particular, the attempt of putting on the same level suspected and proven EDCs. "This goes too far, goes too quickly and it's not based on scientific evidence," said centre-right British MEP Julie Girling. Green and liberal lawmakers strongly criticised the definition of EDCs included in the Commission strategy, as it seems to apply only to pesticides and other plant production products. "Now we know that 80% of exposure comes through the food, so EDCs should be banned in all of the materials in contact with food but also in cosmetics and toys," said Belgian liberal Frédérique Ries.

Strong political signal

Euractiv asked Prof. Barbara Demeneix, chair of Endocrine-Disrupting Chemicals Task Force at Endocrine Society and among the authors of a scientific report on EDCs commissioned by the Parliament's PETI committee published last March, for her thoughts. She hailed the call to take concrete action to regulate endocrine disruptors, which are so prevalent in our daily lives. According to the scientist, the Parliament has sent a strong political signal to both European ministers and the Commission with the adoption of this resolution by a clear cross-party consensus. "Their call for clear and prompt EU actions is fully justified by the available science-based evidence of increasing damage to public health and it can no longer be ignored by the EU and other countries," Demeneix said. Asked about the Perfluoroalkylated substances (PFAS), she said that the topic is particularly worrying, as several thousand of them exist and only a couple are banned. "The fact that these substances interfere with thyroid hormone homeostasis and affect immune responses is clearly demonstrated, both by epidemiology and laboratory tests," she concluded.

Euractiv, 19 April 2019

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

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Germany TRGS 900 Workplace exposure limits updated

2019-04-26

On 29 March 2019, the German Committee on Hazardous Substances (Ausschuss für Gefahrstoffe - AGS) Technical Rules for Hazardous Substances (TRGS) 900 Workplace exposure limits were updated. The following substance were added:

- 4-Chloraniline
- Decan-1-ol
- Decyloleate
- o-Diethylbenzol
- m-Diethylbenzol
- p-Diethylbenzol
- Diethylbenzene isomers
- Ethyldimethylamine
- Glutaric acid
- Isodecyloleate
- Coconut oil
- (Z)-N-methyl-N-(1-oxo-9-octadecenyl)glycine
- Sodium chloroacetate
- Propylene carbonate

The following substances were deleted:

- Dodecan-1-ol
- Tetradecanol
- Hexadecan-1-ol
- Octadecan-1-ol
- 2-Hexyldecan-1-ol

The limits of the following substances were updated:

- Azinphos-methyl
- 2-Butoxyethanol
- 2-Butoxyethylacetate
- Chloroacetic acid
- Dimethoxymethane
- Acetic acid anhydride
- 1-Hexanol

On 29 March 2019, the German Committee on Hazardous Substances (Ausschuss für Gefahrstoffe - AGS) Technical Rules for Hazardous Substances (TRGS) 900 Workplace exposure limits were updated.

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- 2-Isopropoxyethanol
- Methoxypropanol
- Methoxypropylacetate
- Octan-1-ol
- 2-(Propyloxy)ethanol
- Pyridine-2-thiol 1-oxide, sodium salt
- 1,1,1-Trichlorethane

Yorda's Hive, 9 April 2019

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

REACH Update

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ECHA releases new submission portal for poison centres

2019-04-25

The European Chemicals Agency (ECHA) has released a new portal that allows companies to prepare and submit information on hazardous mixtures that can be used by poison centres. ECHA's submission portal for poison centres is a secure, online way to centrally manage notifications – creating, submitting and following their status. It is based on the harmonised format which defines the information requirements set in the CLP Regulation. The portal allows companies to notify several Member States in which they intend to place their products on the market with a single submission. This will reduce companies' administrative burden and costs when submitting information on hazardous mixtures to appointed bodies in EU Member States and EEA countries. ECHA is not charging a fee for the use of the portal but some Member States may levy fees to cover their costs. Notifications submitted through the portal will be valid once the relevant Member State is ready to accept them. Further improvements to the user interface and more functionalities will be implemented in future releases of the portal in July and November 2019.

Background

Under the Classification, Labelling and Packaging (CLP) Regulation, companies placing hazardous mixtures on the market have to provide information about these mixtures to the relevant national appointed bodies. This information has to be provided in a harmonised format from 1 January 2020 for mixtures for consumer use, from 1 January 2021 for mixtures for professional use, and from 1 January 2024 for mixtures for industrial use. The appointed bodies in Member States make this information available to poison centres so that they can provide rapid medical advice in the event of an emergency. Further information is available at:

- [ECHA's submission portal for poison centres](#)
- [What is ECHA's submission portal for poison centres?](#)
- [Poison centres website](#)
- [Overview of Member States decisions in relation to implementation of the Poison Centre Notifications - \(24 April 2019\)](#)

ECHA, 24 April 2019

<http://echa.europa.eu>

The European Chemicals Agency (ECHA) has released a new portal that allows companies to prepare and submit information on hazardous mixtures that can be used by poison centres.

REACH Update

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ECHA's Interact Portal – new collaboration channel for authorities launched

2019-04-25

The European Chemicals Agency's (ECHA) Interact Portal is a one-stop shop for Member State authorities and committee members to collaborate with each other and ECHA and to access process-specific information and tools relevant to their work. For example, the portal provides authority users with easy access to tools such as REACH-IT, R4BP, ePIC and IUCLID. Members of ECHA's scientific committees, advisers and rapporteurs can also access the Collaboration tool for the joint preparation of documents. The Interact Portal replaces the previous portal dashboards for Member State competent authorities and national enforcement authorities. ECHA will continue to develop its features and functionalities for future releases. The portal can be accessed at: [Interact portal](#)

ECHA News, 24 April 2019

<http://echa.europa.eu>

Registered substances mapped for regulatory action

2019-04-25

The first report on the Integrated Regulatory Strategy presents a mapping of the universe of registered substances on the EU market. This information will help authorities in identifying substances of concern, planning their work, and monitoring the progress made in regulating these substances. A copy of the report is available at: [Report](#)

ECHA News, 24 April 2019

<http://echa.europa.eu>

New features in REACH-IT

2019-04-25

The European Chemicals Agency (ECHA) has announced that there are new features available in REACH-IT. There is now an easy way change the contact person for multiple assignments in a single go, for example, if you want to change the contact person in all your joint submissions. In addition, REACH-IT has a new status available for PPORD notifications – 'Expired'. You will be notified through messages to your REACH-IT account if your notification has expired. An expired notification cannot be updated,

The European Chemicals Agency's (ECHA) Interact Portal is a one-stop shop for Member State authorities and committee members to collaborate with each other and ECHA and to access process-specific information and tools relevant to their work.

REACH Update

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so make sure you submit your update on time. Further information is available at: [More information](#)

ECHA News, 24 April 2019

<http://echa.europa.eu>

Authorisations granted for uses of two substances

2019-04-25

The European Commission has granted authorisations for two substances. The substances are as follows:

- one use of 1,2-dichloroethane (EC 203-458-1, CAS 107-06-2) to EURENCO; and
- one use of chromium trioxide (EC 215-607-8; CAS 1333-82-0) to Federal-Mogul Valvetrain GmbH.

The review period for 1,2-dichloroethane expires on 21 November 2021 and for chromium trioxide on 21 September 2029. Further information is available at: [Summary in Official Journal](#)

ECHA News, 24 April 2019

<http://echa.europa.eu>

The European Commission has granted authorisations for two substances.

Janet's Corner

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Cell Phone

2019-04-26



SASSYHANDTURKEY.COM



CELL PHONE

Hazard Alert

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Diesel Exhaust

2019-04-08

Diesel is a type of fuel derived from crude oil. Large engines, including those used in many trucks, buses, trains, construction and farm equipment, generators, ships, and in some cars, run on diesel fuel. [1] Diesel engines convert the chemical energy contained in the fuel into mechanical power. Diesel fuel is injected under pressure into the engine cylinder where it mixes with air and where the combustion occurs. The exhaust gases which are discharged from the engine contain several constituents that are harmful to human health and to the environment. [2] The exhaust from diesel engines is made up of 2 main parts: gases and soot. Each of these, in turn, is made up of many different substances. The gas portion of diesel exhaust is mostly carbon dioxide, carbon monoxide, nitric oxide, nitrogen dioxide, sulphur oxides, and hydrocarbons, including polycyclic aromatic hydrocarbons (PAHs). The soot (particulate) portion of diesel exhaust is made up of particles such as carbon, organic materials (including PAHs), and traces of metallic compounds. Both the gases and the soot of diesel exhaust contain PAHs. [1]

USES [3]

Diesel fuel has many uses. In agriculture, it fuels more than two-thirds of all farm equipment in the United States, because diesel engines can perform demanding work. In addition, diesel is the most widely used fuel for public buses and school buses throughout the United States. In the construction industry, diesel fuel powers engines required for performing demanding construction work, like lifting steel beams, digging foundations and trenches, drilling wells, paving roads and moving soil — safely and efficiently. Diesel also powers the movement of America's freight in trucks, trains, boats and barges; 94% of our goods are shipped using diesel-powered vehicles. The military also uses diesel for fighting vehicles like tanks and trucks, because diesel fuel is less flammable and explosive and less likely to stall than gasoline. Additionally, diesel fuel is used in diesel engine-generators to generate electricity. Many industrial facilities, large buildings, institutional facilities, hospitals, and electric utilities have diesel generators for backup and emergency power supply. Most remote villages in Alaska use diesel generators for their electricity.

Diesel is a type of fuel derived from crude oil.

Hazard Alert

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SOURCES & ROUTES OF EXPOSURE [4]

Diesel exhaust particles and gases are suspended in the air, so exposure to this pollutant occurs whenever a person breathes air that contains these substances. The prevalence of diesel-powered engines makes it almost impossible to avoid exposure to diesel exhaust or its byproducts, regardless of whether you live in a rural or urban setting. However, people living and working in urban and industrial areas are more likely to be exposed to this pollutant. Those spending time on or near roads and freeways, truck loading and unloading operations, operating diesel-powered machinery or working near diesel equipment face exposure to higher levels of diesel exhaust and face higher health risks.

HEALTH EFFECTS [5]

Acute Effects

The acute health effects associated with exposure to diesel exhaust exposure include irritation of the nose and eyes, lung function changes, respiratory changes, headache, fatigue and nausea.

Chronic Health Effects

Chronic exposures are associated with cough, sputum production and lung function decrements. In addition to symptoms, exposure studies in healthy humans have documented a number of profound inflammatory changes in the airways, notably, before changes in pulmonary function can be detected. It is likely that such effects may be even more detrimental in asthmatics and other subjects with compromised pulmonary function. In addition, there are observations supporting the hypothesis that diesel exhaust is one important factor contributing to the allergy pandemic. For example, in many experimental systems, diesel exhaust particles can be shown to act as adjuvants to allergen and hence increase the sensitisation response

Carcinogenicity [1]

The International Agency for Research on Cancer (IARC) is part of the World Health Organisation (WHO). Its major goal is to identify causes of cancer. IARC classifies diesel engine exhaust as "carcinogenic to humans," based on the evidence that it is linked to an increased risk of lung cancer.

The National Toxicology Program (NTP) is formed from parts of several different US government agencies, including the National Institutes of Health (NIH), the Centres for Disease Control and Prevention (CDC), and

Hazard Alert

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the Food and Drug Administration (FDA). The NTP has classified exposure to diesel exhaust particulates as “reasonably anticipated to be a human carcinogen.”

The US Environmental Protection Agency (EPA) maintains the Integrated Risk Information System (IRIS), an electronic database that contains information on human health effects from exposure to various substances in the environment. The EPA classifies diesel exhaust as “likely to be carcinogenic to humans.”

The National Institute for Occupational Safety and Health (NIOSH) is part of the CDC that studies exposures in the workplace. NIOSH has determined that diesel exhaust is a “potential occupational carcinogen.”

REDUCING EXPOSURE TO DIESEL EXHAUST [1]

Diesel exhaust can cause several health problems and can most likely increase lung cancer risk, so it makes sense to lower your exposure to it whenever possible. However, since most human exposure comes from transportation-related diesel exhaust near highways, government regulations may be more effective in limiting exposure than individual choices.

At work

If you are exposed to diesel exhaust at work, there are ways to reduce or prevent exposures. Some of these measures will also protect you from other chemical exposures that are likely to happen in the workplace. Talk with your employer to be sure that you are protected adequately. Personal protective equipment, such as respirators, may be a key part of a workplace protective program. If needed, engineering changes, such as ventilating the exhaust away from where you breathe, can also be important. Good work practices, such as changing clothes after work, washing hands regularly, and keeping food out of the work area, may be helpful as well.

Where you live and play

If you are exposed to diesel exhaust fumes in your environment, you can take some of the same precautions. For example, you can avoid spending time near large sources of diesel exhaust, such as near trucks and buses. Commuting to and from work is a potential source of diesel exhaust exposure for many people, whether using car or some type of public transportation. For some people, working from home (telecommuting or

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teleworking) may be an option to lower their exposure, as well as to save money on commuting expenses.

REGULATION [6,7,8]

United State:

- EPA's inhalation Reference Concentration, which estimates a safe daily exposure level during a lifetime is 5 $\mu\text{g}/\text{m}^3$.
- OSHA has not established a standard for diesel exhaust as a unique hazard however exposures to various chemical components of diesel exhaust are addressed in specific standards for general industry and shipyard employment. These standards are available at: <http://www.osha.gov/SLTC/dieselexhaust/>

Australia:

- The Australian National Pollutant Inventory has set occupational exposure limits for diesel exhaust (prior to the new carcinogen classification). These limits are 10 mg per m^3 of air averaged over an 8 hour shift, and public exposure limits at 8 $\mu\text{g}/\text{m}^3/\text{yr}$.

European Union:

- There are very few European Union countries that have an occupational exposure limit (OEL) for diesel exhaust. In Austria, where there is a limit, it is set at 100 $\mu\text{g}/\text{m}^3$; fewer than 5% of exposures in Europe exceed this figure.

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Gossip

CHEMWATCH

Jellyfish-inspired electronic skin can heal itself while wet

2019-04-09

A new electronic skin that is transparent, stretchable, touch-sensitive, and self-healing in aquatic environments gets its inspiration from jellyfish. "One of the challenges with many self-healing materials today is that they are not transparent and they do not work efficiently when wet," says Benjamin Tee, assistant professor of materials science and engineering at the National University of Singapore. "These drawbacks make them less useful for electronic applications such as touchscreens which often need to be used in wet weather conditions. "With this idea in mind, we began to look at jellyfishes—they are transparent, and able to sense the wet environment. So, we wondered how we could make an artificial material that could mimic the water-resistant nature of jellyfishes and yet also be touch sensitive," says Tee, who has worked on electronic skins for many years and was part of the team that developed the first ever self-healing electronic skin sensors in 2012. The researchers created a gel consisting of a fluorocarbon-based polymer with a fluorine-rich ionic liquid. When researchers combine the two, the polymer network interacts with the ionic liquid via highly reversible ion-dipole interactions, which allows it to self-heal. "Most conductive polymer gels such as hydrogels would swell when submerged in water or dry out over time in air," Tee says. "What makes our material different is that it can retain its shape in both wet and dry surroundings. It works well in sea water and even in acidic or alkaline environments." To create the electronic skin, the team printed the material into electronic circuits. As a soft and stretchable material, its electrical properties change when touched, pressed, or strained. "We can then measure this change, and convert it into readable electrical signals to create a vast array of different sensor applications," says Tee, who is also from the NUS Biomedical Institute for Global Health Research and Technology. "The 3D printability of our material also shows potential in creating fully transparent circuit boards that could be used in robotic applications. We hope that this material can be used to develop various applications in emerging types of soft robots." Soft robots, and soft electronics in general, aim to mimic biological tissues to make them more mechanically compliant for human-machine interactions. In addition to conventional soft robot applications, the material's waterproof technology enables the design of amphibious robots and water-resistant electronics. Another advantage of the skin is its potential to reduce waste. "Millions of tonnes of electronic waste from devices like broken mobile phones or tablets are generated globally every year. We are hoping to create a future

A new electronic skin that is transparent, stretchable, touch-sensitive, and self-healing in aquatic environments gets its inspiration from jellyfish.

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where electronic devices made from intelligent materials can perform self-repair functions to reduce the amount of electronic waste in the world," Tee says. Tee and his team are hoping to explore further possibilities of the material. "Currently, we are making use of the comprehensive properties of the material to make novel optoelectronic devices, which could be utilised in many new human-machine communication interfaces," he says. The study appears in *Nature Electronics*. Additional co-authors are from Tsinghua University and the University of California, Riverside.

Futurity, 1 April 2019

<http://www.futurity.org>

Sun-loving microbe chows down on electricity for fuel

2019-04-09

A new study explains the cellular processes that allow a sun-loving microbe to "eat" electricity—transferring electrons to fix carbon dioxide to fuel its growth. Researchers showed how a naturally occurring strain of *Rhodospirillum rubrum* takes up electrons from conductive substances like metal oxides or rust. The work appears in the journal *Nature Communications*. The study builds on a previous discovery from Arpita Bose, assistant professor of biology in Arts & Sciences at Washington University in St. Louis, that *R. rubrum* TIE-1 can consume electrons from rust proxies like poised electrodes, a process called extracellular electron uptake. *R. rubrum* is phototrophic, which means that it uses energy from light to carry out certain metabolic processes. The new research explains the cellular sinks where this microbe dumps the electrons it eats from electricity. "It clearly shows for the first time how this activity—the ability for the organism to eat electricity—is connected to carbon dioxide fixation," says Bose, who studies microbial metabolisms and their influence on biogeochemical cycling. This mechanistic knowledge can help inform efforts to harness the microbe's natural ability for sustainable energy storage or other bioenergy applications—a potential that has caught the attention of the Department of Energy and Department of Defence. "R. rubrum strains can be found in...places like a rusty bridge in Woods Hole, Massachusetts where TIE-1 was isolated from," Bose says. "Really, you can find these organisms everywhere. This suggests that extracellular electron uptake might be very common." "The main challenge is that it's an anaerobe, so you need to grow it in an environment that doesn't have oxygen in order for it to harvest light energy," adds Michael Guzman, a PhD candidate in Bose's laboratory. "But the flip side to that is that those challenges are met with a lot of versatility in this organism that a lot of

A new study explains the cellular processes that allow a sun-loving microbe to "eat" electricity—transferring electrons to fix carbon dioxide to fuel its growth.

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other organisms don't have." In their new paper, the researchers showed that the electrons from electricity enter into proteins in the membrane that are important for photosynthesis. Surprisingly, when they deleted the microbe's ability to fix carbon dioxide, they observed a 90 percent reduction in its ability to consume electricity. "It really wants to fix carbon dioxide using this system," Bose says. "If you take it away—this innate ability—it just doesn't want to take up electrons at all." She says that the reaction is similar in some ways to a rechargeable battery. "The microbe uses electricity to charge its redox pool, storing up the electrons and making it highly reduced," Bose says. "To discharge it, the cell reduces carbon dioxide. The energy for all this comes from sunlight. The whole process keeps repeating itself, allowing the cell to make biomolecules with nothing more than electricity, carbon dioxide, and sunlight." The new research answers basic science questions and provides plenty of opportunity for future bioenergy applications. "For a long time, people have known that microbes can interact with analogues of electrodes in the environment—that is, minerals that are also charged," Guzman says. "But no one really appreciated how this process could also be done by photoautotrophs, such as these types of organisms that fix their own carbon and use light to make energy. This research fills a poorly understood gap in the field." Bose's lab is working on using these microbes to make bioplastics and biofuels. "We hope that this ability to combine electricity and light to reduce carbon dioxide might be used to help find sustainable solutions to the energy crisis," Bose says. Support for the work came from the National Institutes of Health, the David and Lucile Packard Foundation Fellowship; the US Department of Energy, and the US Department of Defence, Army Research Office; as well as a Collaboration Initiation Grant; an Office of the Vice Chancellor of Research Grant; and an International Centre for Energy, Environment and Sustainability Grant from Washington University in St. Louis.

Futurity, 29 March 2019

<http://www.futurity.org>

Sorry, graphene—borophene is the new wonder material that's got everyone excited

2019-04-09

Not so long ago, graphene was the great new wonder material. A super-strong, atom-thick sheet of carbon "chicken wire," it can form tubes, balls, and other curious shapes. And because it conducts electricity, materials scientists raised the prospect of a new era of graphene-based computer

Stronger and more flexible than graphene, a single-atom layer of boron could revolutionise sensors, batteries, and catalytic chemistry.

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processing and a lucrative graphene chip industry to boot. The European Union invested €1 billion to kick-start a graphene industry. This brave new graphene-based world has yet to materialise. But it has triggered an interest in other two-dimensional materials. And the most exciting of all is borophene: a single layer of boron atoms that form various crystalline structures. The reason for the excitement is the extraordinary range of applications that borophene looks good for. Electrochemists think borophene could become the anode material in a new generation of more powerful lithium-ion batteries. Chemists are entranced by its catalytic capabilities. And physicists are testing its abilities as a sensor to detect numerous kinds of atoms and molecules. Today, Zhi-Qiang Wang at Xiamen University in China and a number of colleagues review the remarkable properties of borophene and the applications they might lead to. Borophene has a short history. Physicists first predicted its existence in the 1990s using computer simulations to show how boron atoms could form a monolayer. But this exotic substance wasn't synthesised until 2015, using chemical vapor deposition. This is a process in which a hot gas of boron atoms condenses onto a cool surface of pure silver. The regular arrangement of silver atoms forces boron atoms into a similar pattern, each binding to as many as six other atoms to create a flat hexagonal structure. However, a significant proportion of boron atoms bind only with four or five other atoms, and this creates vacancies in the structure. The pattern of vacancies is what gives borophene crystals their unique properties. Since borophene's synthesis, chemists have been eagerly characterizing its properties. Borophene turns out to be stronger than graphene, and more flexible. It a good conductor of both electricity and heat, and it also superconducts. These properties vary depending on the material's orientation and the arrangement of vacancies. This makes it "tunable," at least in principle. That's one reason chemists are so excited. Borophene is also light and fairly reactive. That makes it a good candidate for storing metal ions in batteries. "Borophene is a promising anode material for Li, Na, and Mg ion batteries due to high theoretical specific capacities, excellent electronic conductivity and outstanding ion transport properties," say Wang and co. Hydrogen atoms also stick easily to borophene's single-layer structure, and this adsorption property, combined with the huge surface area of atomic layers, makes borophene a promising material for hydrogen storage. Theoretical studies suggest borophene could store over 15% of its weight in hydrogen, significantly outperforming other materials. Then there is borophene's ability to catalyse the breakdown of molecular hydrogen into hydrogen ions, and water into hydrogen and oxygen ions. "Outstanding catalytic performances of borophene have been found in hydrogen evolution

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reaction, oxygen reduction reaction, oxygen evolution reaction, and CO₂ electroreduction reaction," say the team. That could usher in a new era of water-based energy cycles. Nevertheless, chemists have some work to do before borophene can be more widely used. For a start, they have yet to find a way to make borophene in large quantities. And the material's reactivity means it is vulnerable to oxidation, so it needs to be carefully protected. Both factors make borophene expensive to make and hard to handle. So, there is work ahead. But chemists have great faith. Borophene may just become the next wonder material to entrance the world.

MIT Technology Review, 5 April 2019

<https://www.technologyreview.com>

Rocket fuel that's cleaner, safer and still full of energy

2019-04-09

Research published in Science Advances shows that it may be possible to create rocket fuel that is much cleaner and safer than the hypergolic fuels that are commonly used today. And still just as effective. The new fuels use simple chemical "triggers" to unlock the energy of one of the hottest new materials, a class of porous solids known as metal-organic frameworks, or MOFs. MOFs are made up of clusters of metal ions and an organic molecule called a linker. Satellites and space stations that remain in orbit for a considerable amount of time rely on hypergols, fuels that are so energetic they will immediately ignite in the presence of an oxidiser (since there is no oxygen to support combustion beyond the Earth's atmosphere). The hypergolic fuels that are currently mainly in use depend on hydrazine, a highly toxic and dangerously unstable chemical compound made up of a combination of nitrogen and hydrogen atoms. Hydrazine-based fuels are so carcinogenic that people who work with it need to get suited up as though they were preparing for space travel themselves. Despite precautions, around 12,000 tons of hydrazine fuels end up being released into the atmosphere every year by the aerospace industry. "This is a new, cleaner approach to making highly combustible fuels, that are not only significantly safer than those currently in use, but they also respond or combust very quickly, which is an essential quality in rocket fuel," says Tomislav Frišćić. He is a professor in the Chemistry Department at McGill, and co-senior author on the paper along with former McGill researcher Robin D. Rogers. "Although we are still in the early stages of working with these materials in the lab, these results open up the possibility of developing a class of new, clean and highly tunable hypergolic fuels for the aerospace industry," says the first author, Hatem

Research published in Science Advances shows that it may be possible to create rocket fuel that is much cleaner and safer than the hypergolic fuels that are commonly used today.

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Titi, a post-doctoral fellow who works in Friščić's lab. Friscis is interested in commercialising this technology, and will work with McGill and Acsynam, an existing spin-off company from his laboratory, to make this happen.

Phys.org, 5 April 2019

<http://phys.org>

Water Behaves Differently to All Other Liquids Because of This Unique Molecular Quirk

2019-04-09

You might not think about it much, but water is super weird. It doesn't behave like any other liquid. And scientists think they have figured out why - and it has to do with the strange arrangement of its molecules. One of the weirdest aspects of water is its unusual density. Normally, liquids become increasingly dense as they are cooled down, but water reaches a maximum density at about 4 degrees Celsius (39.2 Fahrenheit). Below this point it is less dense, so when it freezes and becomes ice at 0 degrees Celsius (32 Fahrenheit), the ice is less dense than the water. This is why water ice floats, and bodies of water freeze from the top down. But that's not all. Water also has really high surface tension - aside from mercury, it has the highest surface tension of all liquids. This is what allows water spiders to skate across the top. To top it all off, water also has an unusually high boiling point, and the fact that so many chemical substances dissolve in it is also really peculiar, if we compare it to other liquids. To dive into some of these bizarre properties, scientists need to drill down to the molecular level. At room temperature and as ice, water has a tetrahedral arrangement of molecules, which means every water molecule is bonded to four others in a rough pyramid shape. In 2018, researchers from the University of Bristol and the University of Tokyo used a supercomputer and computer modelling to make changes in this pyramid-like nature of water molecules. By making these adjustments, they could make water behave more like other liquids - for instance, making ice denser than liquid water, so that it sinks to the bottom. This, the team said, worked across all of water's peculiarities - indicating that water's anomalous properties are a direct result of its special molecular arrangement. "With this procedure, we have found that what makes water behave anomalously is the presence of a particular arrangement of the water's molecules, such as the tetrahedral arrangement," explained lead author John Russo. "Four of such tetrahedral arrangements can organise themselves in such a way that they share a common water molecule at the centre without overlapping. It is the presence of this highly ordered arrangement of water molecules,

You might not think about it much, but water is super weird. It doesn't behave like any other liquid. And scientists think they have figured out why - and it has to do with the strange arrangement of its molecules.

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mixed with other disordered arrangements, that gives water its peculiar properties." Without water being the way it is, life as we know it wouldn't be possible. It doesn't compress easily, which means it can be pushed around - flowing through our veins carrying our blood cells, for instance. And because it's such a good solvent, the water in our bodies can dissolve the nutrients we need to function. Even the low density of water ice helps life - if lakes froze from the bottom, life within them would die. And that same low density is also why water expands when frozen - which in turn has helped shaped our planet when water seeps into rocks, freezes, expands, and breaks the rock apart from the inside. The Universe never ceases to be an absolutely gobsmacking place. The research has been published in PNAS.

Science Alert, 7 April 2019

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

UK's Sabre space plane engine tech in new milestone

2019-04-09

UK engineers developing a novel propulsion system say their technology has passed another key milestone. The Sabre air-breathing rocket engine is designed to drive space planes to orbit and take airliners around the world in just a few hours. To work, it needs to manage very high temperature airflows, and the team at Reaction Engines Ltd has developed a heat-exchanger for the purpose. This key element has just demonstrated an impressive level of performance. It has shown the ability to handle the simulated conditions of flying at more than three times the speed of sound. It did this by successfully quenching a 420C stream of gases in less than 1/20th of a second. The REL group is confident its "pre-cooler" technology can now go on to show the same performance in conditions that simulate flying above five times the speed of sound, or Mach 5. That would mean rapidly dumping the energy in a 1,000-degree airflow. "We're now able to prove many of the claims we've been making as a business, backed up by very high-quality data," REL's CEO Mark Thomas told BBC News. "In this most recent experiment, we've near-instantaneously transferred 1.5 Megawatts of heat energy - the equivalent of 1,000 homes' worth of heat energy." The testing was conducted at a dedicated facility at the Colorado Air and Space Port in the US. Sabre can be thought of as a cross between a jet engine and a rocket engine. At slow speeds and at low altitude, it would behave like a jet, burning its fuel in a stream of air scooped from the atmosphere. At high speeds and at high altitude, it would then transition to full rocket mode, combining the fuel with

UK engineers developing a novel propulsion system say their technology has passed another key milestone.

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a small supply of oxygen the vehicle had carried aloft. The early air-breathing approach would deliver substantial weight savings, and allow a space plane, for example, to go straight to orbit without throwing away propellant stages on the way up, as rockets do now. But the concept brings with it an immense heat challenge. The faster the flow of air into the engine's intake during the high-speed ascent, the higher the temperature. And the heat would rise still further once the flow was slowed and compressed prior to entering the combustion chambers. Such conditions would ordinarily melt the insides of the engine. Sabre's pre-cooler seeks to solve this problem by efficiently, and swiftly, extracting the heat by first passing the intake gases through a tightly packed array of fine tubing. This tubing is fed with chilled helium. In 2012, REL put the pre-cooler in front of a viper jet engine and sucked ambient air through the heat-exchanger. The gas stream immediately dropped to minus-150C. Now, the company has flipped the set-up, putting the jet engine from an old F-4 Phantom fighter-bomber in front of the pre-cooler to drive hot gases directly across the piping array. The completed Colorado experiment replicates the thermal conditions corresponding to flight at Mach 3.3, the record-breaking speed at which the American SR-71 Blackbird spy plane used to operate. Importantly, though, the pre-cooler took out all the heat. "This technology has wide application, not just in the immediate, obvious domain of high-speed flight but across the aerospace industry more generally, and into more commercial applications - anywhere there's a significant heat-management challenge and you're looking for ultra-lightweight, miniaturised, high-performance solutions," Mr Thomas said. The Colorado tests continue. Meanwhile, back in England, REL is progressing towards a demonstration of the core part of the engine, expected to get under way next year. This core combustion section recently passed its preliminary design review under the eye of propulsion experts at the European Space Agency. Esa has been brought in by the UK government to act as a technical auditor on the project. The Oxfordshire company is developing Sabre with the support of BAE Systems, Rolls-Royce and Boeing. All are keen to see the many years of refinement on the engine concept finally come to fruition.

BBC News, 8 April 2019

<http://news.bbc.co.uk>

Researchers are studying how slug glue achieves its strong sticking power and flexibility, insights that could be used to create better medical adhesives.

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Slug glue reveals clues for making better medical adhesives

2019-04-09

The Dusky Arion slug produces a defensive glue that fouls the mouthparts of any would-be predator. Two new studies reveal more about how this glue achieves its strong sticking power and flexibility, insights that could be used to create better medical adhesives. "Typical sutures like staples and stitches often lead to scarring and create holes in the skin that could increase the chance of infection after surgery," said Rebecca Falconer, who conducted one of the studies. "Understanding the roles of adhesive proteins in the slug glue would aid in the creation of a medical adhesive that can move and stretch yet still retain its strength and adhesiveness." Falconer and Christopher Gallego-Lazo, undergraduate researchers in the lab of Andrew Smith, PhD, at Ithaca College, will present their research at the American Society for Biochemistry and Molecular Biology annual meeting during the 2019 Experimental Biology meeting to be held April 6-9 in Orlando, Fla. Falconer analysed 11 proteins unique to the slug glue that were previously identified by Smith's research team. Using recombinant DNA technology, she produced abundant amounts of each protein for analysis. The techniques she developed could also be used to reproduce the proteins for a humanmade glue. The analysis revealed that some of the proteins tend to bind to themselves or with other proteins to form a three-dimensional network. These findings suggest that this oligomerisation may be required for some of the proteins to be most functional. Gallego-Lazo's study focused on understanding the double network structure that makes the slug glue highly deformable but able to withstand large amounts of force. The glue has a stiff protein network that uses sacrificial bonds to absorb energy, protecting an intertwined deformable network of carbohydrates. Gallego-Lazo discovered that changing specific chemical bonds within the slug glue's protein network modified the glue's strength. These bonds can be reformed naturally, enabling the glue to deform while maintaining its strength. "Few studies on biological adhesives have identified the exact nature of the bonds holding the glue together," said Gallego-Lazo. "This knowledge can guide the development of an organic synthetic adhesive that would reduce the risk of infection and scarring compared to stitches and staples and could be applied rapidly and simply."

Science Daily, 8 April 2019

<http://www.sciencedaily.com>

Sensors made of hairlike pillars and graphene flakes can detect the direction and force of airflow

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Hairy electronic skin catches the breeze

2019-04-09

Designing sensors that mimic those in human skin could lead to more realistic prosthetic limbs that can feel a light touch or the warm sun. But no flexible electronic skin so far has included the small feelers that make mammals unique: hair. Now, by placing microscopic polymer hairs on top of graphene, researchers have made a skin-like sensing device that can feel wind and detect its direction and angle (ACS Appl. Mater. Interfaces 2019, DOI: 10.1021/acsami.9b01427). The technology, they say, could lead to wearable sensors that are more sensitive and responsive and to new kinds of soft or winged robots. Electronic skin has typically been made of an array of sensors embedded in or printed on a rubbery polymer. Recent innovations include e-skin that can monitor vital signs or can heal itself. Yet most research so far has focused on mimicking skin's essential ability to sense touch and temperature, which would allow a robotic arm to pick up a cup or know if it's hot. Hair enhances the skin's ability to sense pressure, especially light pressure such as a landing bug or a gentle breeze. Scientists have recently found that bats use hair on their wings to detect airflow and change flight direction in a split second. Artificial skin with hair would more closely mimic the real thing, says Changyun Pang, a chemical engineer at Sungkyunkwan University. Others have attempted hairy sensors before, but they were complicated to make and mounted on rigid substrates. Such strategies won't work for soft e-skins or flexible wearable electronics, he says. Pang and his colleagues made a 4-by-4 array of sensors by spraying a suspension of graphene nanoflakes through a stencil onto a piece of flexible polyethylene. Each sensor is a 4 by 4 mm patch of graphene nanoflakes only 15 μm thick. Applying pressure on the sensors pushes the nanoflakes together, changing the electrical resistance. Using a different stencil, the researchers then top the sensor area with thicker 170 μm graphene nanoflake films that are highly conductive and form a pair of electrodes. Next comes the hair. The researchers moulded a thin poly(dimethylsiloxane) film covered with a forest of microscopic pillars. They placed this on top of one half of the sensor array so that one half is smooth while the other is hairy. A robot moves the farthest when air blows perpendicular to its sail. When air blows at a 45° angle, a sensor detects airflow angle and direction, and the sail pivots to face the breeze and move forward. To test the device, the researchers blew air on it and measured the electrical current from each sensor in the array. The breeze bent the microhairs and put pressure on the graphene sensors, changing their output current. Stronger drafts generated higher current. Researchers calculated the flow's direction by looking at a map of the sensors' output;

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pillars directly facing the wind bent more. To measure the angle of airflow, the researchers measured the difference in the current from the smooth side, which monitors downward force, and the hairy side, which measures force across the array. The hairy sensors can detect an airflow pressure of 0.2 kilopascal—a gentle pressure that our skin can feel. Although previous e-skins have been able to sense pressures below a kilopascal, those devices cannot trace the flow direction and angle. Finally, as a practical demonstration, the team attached the hairy sensor to a wheeled robot powered by a sail. The sensor detected airflow and rotated the sail, adjusting it to the wind direction so the robot could move forward. Researchers have made whiskers that can detect surface texture before, says Darren J. Lipomi, a nanoengineer at the University of California, San Diego. But this work is novel because it uses rubbery micropillars to relay the mechanical forces from wind to the graphene sensors in the device, he says, thus mimicking the hair follicle receptors in human skin. Given the simple printing and moulding techniques, it should be straightforward to produce practical sensors on a large area, he adds.

Chemical & Engineering News, 8 April 2019

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

In the battery materials world, the anode's time has come

2019-04-09

It was 2007. Apple CEO Steve Jobs announced the iPhone, J. K. Rowling finished her seventh and final Harry Potter novel, and the worst financial crisis since the 1930s was about to hit. It was also the year that Gene Berdichevsky, an engineer and employee number 7 at Tesla, the electric car pioneer, began questioning why gains in recent years in the energy density of lithium-ion batteries had fallen from 7–8% to 3–4%. With returns from improvements in battery cathode performance beginning to taper, Berdichevsky began to consider the next bottleneck—the poor energy density of the traditional graphite anode. Tens of start-ups and established materials firms eventually began asking the same question. Many came to the same conclusion as Berdichevsky: that silicon or lithium would be ideal as an anode material. In theory, they are able to hold roughly 10 times the number of electrons as graphite, leading to lithium-ion batteries with 20–40% higher energy density. The catch is that the anode also absorbs a large number of lithium ions during charging. Graphite handles them well, but a silicon anode swells more than 300%, causing its surface to crack and energy storage performance to drop rapidly. Lithium-metal anodes don't

After focusing on improving the cathode, battery material developers are turning to novel anode materials

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present an expansion problem, but they are expensive and present other technical problems. After more than 10 years of R&D, several material developers think they have solved the expansion issues associated with using silicon in anodes, and they are starting to bring their materials to the market. Substantial business challenges lie ahead, not least a potential intellectual property showdown because so many companies are developing technologies in such a narrow field. But it's clear that the anode's time has come. Anode material developers are well aware that the market potential is big and getting bigger as lithium-ion battery use grows in portable devices, electric cars, and grid energy storage. The anode is worth 10–15% of the total cost of a lithium-ion battery, according to Chloe Holzinger, an energy storage analyst with Lux Research. The global anode material market could be worth \$10 billion by 2025, she says. The research is following the money, says Jeff Chamberlain, former head of Argonne National Laboratory's battery development activities and now CEO of Volta Energy Technologies, a venture capital firm investing in battery technologies. "There is no surprise that people are seeking to improve the lithium-ion battery, and the anode is the place," he says. For Berdichevsky, especially, the journey to an improved anode has been long. He left Tesla in 2008 to return to school at Stanford University, earning an MS in energy-dense anode materials. He cofounded and became CEO of Sila Nanotechnologies in 2011 to develop a commercial silicon anode. The conventional wisdom is to replace, say, 10% of the graphite in a battery anode with silicon metal or oxide, improving density without introducing too much swelling. Sila is taking a different approach. The company has created a nanocomposite of covalently bonded nanostructures of which 50% are silicon and the rest undisclosed nongraphite materials. The composite is porous but encapsulated with a sealed outer layer that prevents electrolyte penetration into the composite, protecting it from damage during charge and discharge. The composite is contained in a porous scaffold structure so it is able to expand and contract without puncturing the coating, Berdichevsky says. "We are not adding our silicon nanocomposite to graphite. We are replacing all the graphite in the anode," he says. Berdichevsky estimates that Sila's material has an energy storage capacity four or five times that of graphite, enabling the energy density of a lithium-ion battery to increase by 20–40%. "A lot of the magic is in how we do the processing. We expect it will be cheaper than graphite at very large scale on a dollar-per-capacity basis," Berdichevsky says. The California-based firm raised \$70 million from investors last year to commercialise the technology, bringing the total invested in the firm to \$125 million. Sila expects its anode materials to be used in batteries for portable devices sometime this year. "By year-end, the material could

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be powering millions of devices," Berdichevsky says. Along with other anode material developers, Sila has an eye on the ballooning auto battery market. The firm has a partnership with the German carmaker BMW, which is investing heavily in electric cars. Berdichevsky is targeting large sales volumes starting in the mid-2020s. For Nexeon, an Abingdon, England-based silicon anode material start-up, the race to commercialization is more akin to a marathon than a sprint.

Now in its 13th year, Nexeon has experienced some lows, including the 2014 mothballing of a \$5 million pilot plant in Abingdon when the firm's nanopillar-structured silicon proved problematic to manufacture at scale and low cost. But Nexeon has taken the lessons learned from that experience and bounced back, Chief Engineer Bill Macklin says. Nexeon is developing two anode materials. NSP-1 features a powdered silicon compound with particles ranging in size from a few to about 10 μm . Its use is limited to about 10% loading by weight in a graphite anode to avoid expansion problems. Compared with graphite, it promises to increase anode capacity by about 30%, leading to a corresponding increase in battery cell energy density of up to 15%. To offer even more energy density, Nexeon is developing NSP-2, a silicon compound featuring engineered porosity at the particle level for use in concentrations far higher than 10% to yield an increase in cell energy density of up to 30% versus graphite. Nexeon is a year into a 3-year project to develop NSP-2 in association with specialty chemical firm Synthomer and University College London. Synthomer is developing a polymer binder for use with Nexeon's silicon anode material, while the university is undertaking materials characterisation. The idea is that, by the end of the project, you have customer validation, scale, demonstrated performance, and intellectual property, Macklin says. "These inputs then form the basis for an investment." Wacker Chemie, which holds an option to take a minority stake in Nexeon, is commercialising its own silicon anode material in lithium-ion button batteries that will debut later this year. The big German silicon producer estimates that its technology could enhance the energy density of such a battery by about 20%. "Most of the market is using silicon suboxides sprinkled in a small percentage into existing graphite. Our approach is to use a silicon-dominated anode," says Christian Hartel, the Wacker board member responsible for R&D. The company is developing a series of strategies to increase energy density, including coatings to protect silicon against swelling and contraction. Moving from button batteries to automotive batteries could take years, Hartel acknowledges. This is partly because the materials that Wacker has developed may have to be modified substantially to maintain a high level of performance over

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many charging cycles, he says. Sila, Nexeon, and Wacker have yet to put a product on the market. In contrast, the Stanford University spin-off Amprius, formed in 2008, is already selling its silicon-graphite compounds commercially in a mix of around 10% silicon and 90% graphite, according to Lux Research's Holzinger. The company didn't respond to C&EN's requests for an interview. Amprius's technology features a shell that encapsulates silicon nanowires. The firm claims its approach overcomes the inherent instability of silicon-containing anodes, enabling their use over hundreds of charge cycles. Amprius also has a 100% silicon anode that Airbus successfully tested in lithium-ion batteries for its Zephyr S pseudosatellite, which travels in the stratosphere rather than in space for applications such as surveillance and navigation. The batteries have an energy density of over 435 (W h)/kg—substantially higher than that of commercial lithium-ion batteries in use today. Manufacturing technologies are much more complex for anodes with high silicon loading, though, so all-silicon anodes for the automotive market are still some ways off, Lux's Holzinger says. Also pursuing an all-metal anode is the lithium-sulfur battery maker Oxis Energy, though in its case the metal is lithium. Lithium-sulfur batteries are known to suffer from fading performance after a number of recharge cycles, but if Oxis can solve this problem, it will be on course to outperform the energy density of the best lithium-ion batteries. A lithium-metal anode has the highest specific capacity of any anode material, at 3,862 (mA h)/g, says Oxis's chief technical officer, David A. Ainsworth. When paired with an optimised sulfur-based cathode, it will allow Oxis's Li-S battery to achieve an energy density of more than 425 (W h)/kg, he says, compared with about 200 (W h)/kg for a lithium-ion battery. Equipping the battery with a lithium sulfide electrolyte protects the lithium-sulfide anode from degradation because the electrolyte instantly forms a film on the anode, Oxis says. With a melting point of more than 900 °C, this coating protects the lithium even at extreme temperatures, the firm says. Oxis raised \$60 million in recent weeks to build its first manufacturing facility. The plant, which will be located in Brazil, will have the capacity to make 2 million battery cell pouches per year. The pouches are set to go into batteries used by the aviation and electric vehicle sectors. Lux's Holzinger doubts that lithium-sulfur battery developers can solve the problem of performance fade. A possible indicator as to how competition between lithium-sulfur and silicon-containing lithium-ion batteries will play out is Airbus's decision to ditch the use of lithium-sulfur batteries in its pseudosatellites and opt for Amprius's silicon anode battery. "We are no longer working with lithium-sulfur as we did not see the performance we require," Airbus says. Yet another firm, the Massachusetts Institute of Technology spin-off SolidEnergy Systems,

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sees a way to keep the benefits of a lithium-metal anode without the potential drawbacks of lithium-sulfur chemistry. SolidEnergy claims it has gotten around the issues associated with lithium-metal anodes—such as sharp, dendritic lithium structures that form on the anode surface—by developing a lithium-ion battery that is anodeless. During its first charge cycle, lithium is back plated onto a copper current collector, activating the battery. The technology also features an electrolyte that is stable in contact with lithium. The system promises double the energy density of a standard lithium-ion battery. It is also the world's lightest rechargeable battery, claims SolidEnergy's CEO, Qichao Hu. The firm plans to break ground this year on a large-scale production facility at an undisclosed site. Despite such plans, industry experts contend that lithium-metal anodes are years away from mass-market introduction. Given lithium-ion batteries' history of catching fire, such as those made in recent years by Samsung, battery makers have become risk averse, Volta Energy's Chamberlain says. The most likely scenario will be the gradual adoption of silicon blended with graphite in anodes, rather than a jump to 100% silicon or lithium, he says. Overshadowing these marketplace developments is uncertainty about intellectual property rights relating to silicon anode technology because so many patents have been filed. About 1,100 patents relating to silicon anodes were filed in 2016 alone, and filings are increasing annually, according to the technology market research firm IDTechEx. Samsung was the most prolific in 2016 with almost 250 patents filed, followed by LG Chem, Panasonic, Sony, and Nexxon. A potential issue for Sila is that the firm's technology appears to be similar to that of Amprius, Lux's Holzinger says. Sila's "patents describe a core shell morphology that is very similar to that of Amprius. This could be a problem for Sila given that Amprius also filed in the US but filed its patent first," she says. A broader challenge for many silicon anode material developers is that after so many years of research they could soon come under financial pressure—if they are not already—to actually start selling their products. Just as the technological breakthroughs are emerging, industry consolidation could be on the way. The winners and losers will likely emerge in the next few years.

Chemical & Engineering News, 7 April 2019

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

Scientists have discovered a new state of physical matter in which atoms can exist as both solid and liquid simultaneously.

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Elements can be solid and liquid at the same time, study reveals

2019-04-09

Scientists have discovered a new state of physical matter in which atoms can exist as both solid and liquid simultaneously. Until now, the atoms in physical material were understood to exist typically in one of three states—solid, liquid or gas. Researchers have found, however, that some elements can, when subjected to extreme conditions, take on the properties of both solid and liquid states. Applying high pressures and temperatures to potassium—a simple metal—creates a state in which most of the element’s atoms form a solid lattice structure, the findings show. However, the structure also contains a second set of potassium atoms that are in a fluid arrangement. Under the right conditions, over half a dozen elements—including sodium and bismuth—are thought to be capable of existing in the newly discovered state, researchers say. Until now, it was unclear if the unusual structures represented a distinct state of matter, or existed as transition stages between two distinct states. A team led by scientists from the University of Edinburgh used powerful computer simulations to study the existence of the state—known as the chain-melted state. Simulating how up to 20,000 potassium atoms behave under extreme conditions revealed that the structures formed represent the new, stable state of matter. Applying pressure to the atoms leads to the formation of two interlinked solid lattice structures, the team says. Chemical interactions between atoms in one lattice are strong, meaning they stay in a solid form when the structure is heated, while the other atoms melt into a liquid state. The study, published in the journal *Proceedings of the National Academy of Sciences*, was supported by the European Research Council and the Engineering and Physical Sciences Research Council. The work was carried out in collaboration with scientists from Xi’an Jiantong University in China. Dr. Andreas Hermann, of the University of Edinburgh’s School of Physics and Astronomy, who led the study, said: “Potassium is one of the simplest metals we know, yet if you squeeze it, it forms very complicated structures. We have shown that this unusual but stable state is part solid and part liquid. Recreating this unusual state in other materials could have all kinds of applications.”

Phys.org, 8 April 2019

<http://phys.org>

A team of researchers from the University of Michigan are pushing the performance of a competing electric vehicle technology—hydrogen fuel cells—to new heights.

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Hydrogen fuel cells: With a database of 500,000 materials, researchers zero in on best bets

2019-04-09

A team of researchers from the University of Michigan are pushing the performance of a competing electric vehicle technology—hydrogen fuel cells—to new heights. A hydrogen fuel cell is a zero-harmful-emissions power source that acts like a cross between a battery and a gas tank. It employs hydrogen as the fuel and harnesses the reaction between hydrogen and oxygen to produce electricity. The only “emission” is water. One limitation of this technology is the ability to store sufficient quantities of hydrogen onboard. The U-M researchers have identified ways to cram more hydrogen than ever before into small storage structures called metal-organic frameworks, increasing the energy density, and, as a result, the projected driving range of a fuel cell vehicle. Metal organic frameworks, or MOFs, are designer materials comprised of metal ions coupled with organic molecules. Their porous nature makes some MOFs among the most promising ways to store hydrogen. Michigan researchers gathered information on all available MOFs, those previously constructed as well as those that remain hypothetical, into a database. High-throughput computer simulations were then used to scour the resulting databank of nearly 500,000 MOFs for those having promising capacities. Three candidates were identified that could surpass previous records for hydrogen storage. The researchers then synthesized these materials and demonstrated their performance. “We’re demonstrating more energy-dense storage than previously shown,” said Don Siegel, U-M associate professor of mechanical engineering. “You might describe it as more efficient—putting more energy into a smaller space and in a lighter package.” As published in *Nature Communications*, the three MOFs are dubbed SNU-70, UMCM-9 and PCN-610/NU-100. Each surpassed the performance of IRMOF-20, another MOF identified by the team in 2017. “These materials establish a new high-water mark for usable hydrogen capacities in MOFs,” the study states. Hydrogen fuel cells have long held promise as a no-emission power source for electric cars. They have, however, taken a backseat to lithium ion batteries, which you’ll find inside most of the portable electronic devices being produced today—from cell phones and tablets, to digital cameras and electric vehicles. Hydrogen fuel cell systems have several advantages over lithium ion batteries. The most abundant element in the universe, hydrogen is far more common than lithium, so there is little chance of there ever being a supply issue. And a hydrogen fuel cell car can recharge at a station in a few minutes, about the same time it takes to fill a gas tank now. In contrast, full charge

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times for lithium battery electric vehicles are typically measured in hours. There are drawbacks that have limited the auto industry's embrace of hydrogen, however. For example, producing hydrogen is currently much more expensive than is extracting and refining petroleum. Transportation of hydrogen fuel is another issue. As a gas, it's difficult to move and store large quantities of hydrogen efficiently, raising questions of whether it needs to be moved in liquid form in semitrucks or shuttled through pipelines as a gas. But the lure of what hydrogen could potentially mean for cars, and the environment, has kept major automakers like Ford, Hyundai, Toyota, Honda and GM involved in its development. Electric vehicle designers are constantly looking to decrease the size of a car's power system as a means of increasing efficiency. By increasing the quantity of hydrogen that can be stored in a MOF adsorbent, Siegel said, the pressure needed to store it can be reduced. The size of the tank can also be reduced. "We want to eliminate the energy storage problem for hydrogen fuel cell vehicles. This shows we're moving in that direction," Siegel said.

Phys.org, 5 April 2019

<http://phys.org>

Engineers develop concept for hybrid heavy-duty trucks

2019-04-09

Heavy-duty trucks, such as the 18-wheelers that transport many of the world's goods from farm or factory to market, are virtually all powered by diesel engines. They account for a significant portion of worldwide greenhouse gas emissions, but little has been done so far to curb their climate-change-inducing exhaust. Now, researchers at MIT have devised a new way of powering these trucks that could drastically curb pollution, increase efficiency, and reduce or even eliminate their net greenhouse gas emissions. The concept involves using a plug-in hybrid engine system, in which the truck would be primarily powered by batteries, but with a spark ignition engine (instead of a diesel engine). That engine, which would allow the trucks to conveniently travel the same distances as today's conventional diesel trucks, would be a flex-fuel model that could run on pure gasoline, pure alcohol, or blends of these fuels. While the ultimate goal would be to power trucks entirely with batteries, the researchers say, this flex-fuel hybrid option could provide a way for such trucks to gain early entry into the marketplace by overcoming concerns about limited range, cost, or the need for excessive battery weight to achieve

Long-haul trucks with electric motors combined with gas-alcohol engines could slash pollution levels and greenhouse gases.

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longer range. The new concept was developed by MIT Energy Initiative and Plasma Fusion and Science Centre research scientist Daniel Cohn and principal research engineer Leslie Bromberg, who are presenting it at the annual SAE International conference on 11 April. "We've been working for a number of years on ways to make engines for cars and trucks cleaner and more efficient, and we've been particularly interested in what you can do with spark ignition [as opposed to the compression ignition used in diesels], because it's intrinsically much cleaner," Cohn says. Compared to a diesel engine vehicle, a gasoline-powered vehicle produces only a tenth as much nitrogen oxide (NOx) pollution, a major component of air pollution. In addition, by using a flex-fuel configuration that allows it to run on gasoline, ethanol, methanol, or blends of these, such engines have the potential to emit far less greenhouse gas than pure gasoline engines do, and the incremental cost for the fuel flexibility is very small, Cohn and Bromberg say. If run on pure methanol or ethanol derived from renewable sources such as agricultural waste or municipal trash, the net greenhouse gas emissions could even be zero. "It's a way of making use of a low-greenhouse-gas fuel" when it's available, "but always having the option of running it with gasoline" to ensure maximum flexibility, Cohn says. While Tesla Motors has announced it will be producing an all-electric heavy-duty truck, Cohn says, "we think that's going to be very challenging, because of the cost and weight of the batteries" needed to provide sufficient range. To meet the expected driving range of conventional diesel trucks, Cohn and Bromberg estimate, would require somewhere between 10 and 15 tons of batteries "That's a significant fraction of the payload" such a truck could otherwise carry, Cohn says. To get around that, "we think that the way to enable the use of electricity in these vehicles is with a plug-in hybrid," he says. The engine they propose for such a hybrid is a version of one the two researchers have been working on for years, developing a highly efficient, flexible-fuel gasoline engine that would weigh far less, be more fuel-efficient, and produce a tenth as much air pollution as the best of today's diesel-powered vehicles. Cohn and Bromberg did a detailed analysis of both the engineering and the economics of what would be needed to develop such an engine to meet the needs of existing truck operators. In order to match the efficiency of diesels, a mix of alcohol with the gasoline, or even pure alcohol, can be used, and this can be processed using renewable energy sources, they found. Detailed computer modelling of a whole range of desired engine characteristics, combined with screening of the results using an artificial intelligence system, yielded clear indications of the most promising pathways and showed that such substitutions are indeed practically and financially feasible. In both the present diesel and the proposed flex-fuel vehicles, the emissions are measured at the tailpipe,

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after a variety of emissions-control systems have done their work in both cases, so the comparison is a realistic measure of real-world emissions. The combination of a hybrid drive and flex-fuel engine is “a way to enable the introduction of electric drive into the heavy truck sector, by making it possible to meet range and cost requirements, and doing it in a way that’s clean,” Cohn says. Bromberg says that gasoline engines have become much more efficient and clean over the years, and the relative cost of diesel fuel has gone up, so that the cost advantages that led to the near-universal adoption of diesels for heavy trucking no longer prevail. “Over time, gas engines have become more and more efficient, and they have an inherent advantage in producing less air pollution,” he says. And by using the engine in a hybrid system, it can always operate at its optimum speed, maximising its efficiency. Methane is an extremely potent greenhouse gas, so if it can be diverted to produce a useful fuel by converting it to methanol through a simple chemical process, “that’s one of the most attractive ways to make a clean fuel,” Bromberg says. “I think the alcohol fuels overall have a lot of promise.” Already, he points out, California has plans for new regulations on truck emissions that are very difficult to meet with diesel engine vehicles. “We think there’s a significant rationale for trucking companies to go to gasoline or flexible fuel,” Cohn says. “The engines are cheaper, exhaust treatment systems are cheaper, and it’s a way to ensure that they can meet the expected regulations. And combining that with electric propulsion in a hybrid system, given an ever-cleaner electric grid, can further reduce emissions and pollution from the trucking sector.” Pure electric propulsion for trucks is the ultimate goal, but today’s batteries don’t make that a realistic option yet, Cohn says: “Batteries are great, but let’s be realistic about what they can provide.” And the combination they propose can address two major challenges at once, they say. “We don’t know which is going to be stronger, the desire to reduce greenhouse gases, or the desire to reduce air pollution.” In the U.S., climate change may be the bigger push, while in India and China air pollution may be more urgent, but “this technology has value for both challenges,” Cohn says.

EurekAlert, 8 April 2019

<http://www.eurekalert.org>

Chemists have identified a way to convert cyclohexane to cyclohexene or cyclohexadiene, important chemicals in a wide range of industrial processes.

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Scientists pioneer new low-temperature chemical conversion process

2019

Chemists spend a great deal of time and energy trying to get chemical reactions to begin or to speed up -- but sometimes it can be just as important to stop them before they go too far. In a recent study from the U.S. Department of Energy's (DOE) Argonne National Laboratory, chemists have identified a way to convert cyclohexane to cyclohexene or cyclohexadiene, important chemicals in a wide range of industrial processes. Importantly, this process takes place at low temperatures, eliminating the creation of carbon dioxide that would have resulted from an unwanted breaking of carbon-carbon bonds. Cyclohexane is an important starting molecule in a wide range of chemical reactions, according to Argonne chemist Stefan Vajda, now at the J. Heyrovský Institute of Physical Chemistry in Prague. However, without a suitable catalyst to initiate the reaction, converting cyclohexane into useful products typically requires elevated temperatures generated through the expenditure of a great deal of energy, and the process may suffer from poor selectivity as well. In the study, Vajda and Argonne chemist Larry Curtiss and their international team of collaborators examined a type of reaction called oxidative dehydrogenation, in which hydrogen molecules are stripped off a larger molecule. By cutting a limited number of hydrogen-carbon bonds, the reaction can produce cyclohexene and cyclohexadiene before combustion to carbon dioxide takes place. The work improved on previous studies by the Argonne team on the dehydrogenation of cyclohexane and cyclohexene by introducing two key components: a sub-nanometre-sized cobalt oxide catalyst on an aluminium oxide support and a controlled oxygen environment. The researchers employed X-ray scattering techniques at Argonne's Advanced Photon Source (APS), a DOE Office of Science User Facility, to monitor the nature and stability of the catalysts during the catalytic testing of the clusters in real time. They discovered that the clusters carried out partial dehydrogenation of the cyclohexane at temperatures right around 100 degrees Celsius -- far lower than had been previously observed for this kind of reaction, and the clusters retained their oxidised nature and stability at reaction temperatures up to 300°C. "The fact that we can make this conversion happen at lower temperatures protects the intermediate dehydrogenation products cyclohexene and cyclohexadiene from being further converted to unwanted products," Vajda said. Vajda and Curtiss noted that the highly selective catalyst is long-lived and does not get poisoned or degraded by the reaction. In theoretical and

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experimental investigation of the size of the catalyst, the researchers found that clusters of size four and twenty-seven atoms were roughly equally efficient in carrying out the reaction. "It seems as though as long as the catalyst is below roughly one nanometre in size, this composition works well -- an important factor for the potential scaleup of this class of catalysts by more traditional, though less size-selective, synthesis routes." Vajda said. To better understand the basic mechanisms behind the activity and selectivity of the cobalt catalysts, the researchers used density functional theory calculations to model the reaction pathways. "The excellent performance of the cobalt clusters can be explained by theoretical calculations, which reveal highly active cobalt atoms in the clusters and show that the oxidised nature of the clusters causes the low-temperature formation of the product," Curtiss explained. A paper based on the study, "Subnanometer cobalt oxide clusters as selective low temperature oxidative dehydrogenation catalysts," was published in the February 27 online issue of Nature Communications. Other authors of the paper included Argonne scientists Sungsik Lee, Avik Halder, Glen Ferguson, Sönke Seifert, and Randall Winans. Other contributors included Detre Teschner and Robert Schlögl from the Fritz-Haber-Institut and the Max-Planck-Institute for Chemical Energy Conversion in Germany, Vasiliki Papaefthimiou from the University of Strasbourg in France, and Jeffrey Greeley from Purdue University. The research was funded by the DOE's Office of Science and by the Air Force Office of Scientific Research.

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<http://www.sciencedaily.com>

Turning organic waste into hydrogen

2019-04-09

An anaerobic digester that lives at the Indian Institute of Chemical Technology in Hyderabad consumes leftover food waste from the institute's cafeteria to produce hydrogen and valuable acids. A narrow tower two stories high sits behind chemical engineer S. Venkata Mohan's lab at the Council of Scientific and Industrial Research's Indian Institute of Chemical Technology. Every other day for 6 months in 2017, he and his team fed this "beast." They collected food waste from the institute's cafeteria, ground it up, filtered out large particles, drained the oils, and added it to the tower, which contains an anaerobic digester filled with a soup of waste and bacteria. Munching on the leftover lunch, those microorganisms didn't produce a conventional biogas, the typical output of digesters. With some scientific innovation from Mohan and his team,

Researchers are using bacteria to transform various types of waste into a clean-burning fuel

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the microbes instead produced a gas rich in hydrogen. Building on the beast's ability to pump out 5 kg of hydrogen per day, Mohan is now in talks with Indian officials to build similar plants 10 times as large to treat municipal waste in Delhi and Mumbai. Mohan is among a small group of researchers around the world who are finding that various organic waste streams—such as food waste, agricultural waste, and wastewater—can be viable sources of hydrogen gas. These researchers seek to generate hydrogen, a fuel that does not produce greenhouse gases when burned, while simultaneously dealing with a growing waste problem. In some cases, these methods enjoy a bonus of producing valuable carbon-based products instead of climate-warming carbon dioxide. "It hopefully will be, in the longer term, a process where we can remove waste, make a fuel, and also make value-added chemicals," says Erwin Reisner, a chemist at the University of Cambridge. India faces some of the world's worst vehicle-induced smog, but it's not the only country interested in hydrogen. The governments of South Korea, France, and Switzerland announced renewed commitments last year to building a hydrogen economy. Japan has invested ¥40 billion (\$348 million) in building hydrogen infrastructure for the 2020 Summer Olympics in Tokyo, hoping to enjoy its legacy after the games are over. Germany launched the world's first hydrogen-powered trains last fall, a pair traveling a 100 km route in northern Germany. And California is building a hydrogen-fuel-cell ferry to serve the San Francisco Bay Area. Even though demand is strong for clean hydrogen fuel, current production of commercial hydrogen creates its own pollution problems. Ninety-six percent of commercial hydrogen comes from steam reforming of natural gas, which produces CO₂ along with hydrogen. For the hydrogen economy to be truly clean, hydrogen must come from a non-fossil-fuel source. Otherwise, "you are just shifting the [CO₂] burden upstream" from vehicle tailpipes, where hydrogen is burned, to the plants where hydrogen is made, says Qiang Dai, a researcher at Argonne National Laboratory who specializes in life-cycle analysis. Currently, the tiny market for renewable hydrogen is dominated by water electrolysis, the electrochemical process of splitting water into hydrogen and oxygen. But it requires plentiful fresh water and renewable electricity at large scale to be green and practical, which limits it to places like Iceland that have excess geothermal energy. In contrast, waste produced by humans is everywhere—and it can be a "very valuable material," Mohan says. In remote areas without electricity, he says, hydrogen produced from waste can power mobile homes and hospitals. Hydrogen is also a valuable chemical that is useful for chemical reactions and processes in industry. "It's the perfect reducing agent," says Zhiyong Ren, a chemist at Princeton University. In 2004, Mohan was working with anaerobic digesters when

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he realised that turning waste into biogas, which is mostly methane, is a flawed strategy. Burning methane produces CO₂, which ultimately gets lost to the atmosphere. "We're losing a lot of resources," he says. That carbon could be going into making other chemicals instead. Typical anaerobic digestion uses a mix of acidogenic and methanogenic bacteria that naturally occur together in food waste to turn organic compounds into methane. The acidogenic bacteria generate hydrogen and short-chain carboxylic acids from the food, along with small amounts of CO₂. The methanogenic bacteria in turn convert the hydrogen, carboxylic acids, and CO₂ into methane. But the acids produced in the first step—acetate, propionic acid, and butyric acid among them—are valuable as feedstocks, and if those chemicals and the hydrogen could be preserved, it would help make hydrogen more cost competitive as a fuel. So, Mohan set out to arrest the digestion process to make hydrogen the main product by inhibiting the methanogens. For close to a decade, Mohan tinkered with bacterial populations in digesters, steering them by varying the organic content of food waste, pH, temperature, and other parameters. He found that exposing the bacterial culture to acid before digestion helps reduce the population of methanogenic bacteria, tripling hydrogen production (RSC Adv. 2016, DOI: 10.1039/c5ra24254a).

Hydrogen from the Farm

Maness chose to focus on *C. thermocellum* in the early 2000s because, unlike many other bacteria, it was known to feed on cellulose—the dominant component of lignocellulose—without any need to pretreat it, Maness says. *C. thermocellum* breaks down cellulose to produce hydrogen and CO₂ while producing lactic acid, formic acid, and ethanol as by-products. Over the years, Maness and her team gradually optimized *C. thermocellum*'s hydrogen production from cellulose by finding competing pathways and knocking them out using genetic engineering. In 2016, a preliminary life-cycle analysis conducted by Argonne's Dai found that Maness's fermentation process, combined with measures to maximize the amount of energy and hydrogen recovered, produced up to 30% less carbon dioxide per kilogram of hydrogen compared with steam reforming of natural gas. Later that year, Maness's team identified a pathway in *C. thermocellum* that actively consumes CO₂ produced by the bacteria (Proc. Natl. Acad. Sci. U.S.A. 2016, DOI: 10.1073/pnas.1605482113). That means the carbon dioxide that is evolved during hydrogen production is recaptured by the bacteria to build cell mass, and less CO₂ would need to be sequestered or captured. Maness's team has also begun genetically engineering *C. thermocellum* to ferment xylose, a sugar derived from

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hemicellulose, along with cellulose to make hydrogen (Biotechnol. Bioeng. 2018, DOI: 10.1002/bit.26590). After identifying the genes that enable xylose consumption in a different bacterium, the researchers inserted those genes into *C. thermocellum*. The new strain doubled hydrogen yield.

Working with Wastewater

Inedible biomass like corn stover could be a source of clean hydrogen fuel. Solid waste isn't the only type of waste that can produce hydrogen. Wastewater contains plenty of raw material that can be turned into fuel. And in 2017, more than 80% of the world's wastewater entered the environment without any filtration or disinfection, according to an estimate by the United Nations Educational, Scientific, and Cultural Organization. The wastewater treatment that does take place consumes 2–4% of electricity produced globally. To help make a dent in the problem of raw wastewater, Princeton's Ren is working on ways to use electroactive bacteria to produce hydrogen from wastewater while treating it. Electroactive bacteria occur naturally in sewers and wastewater treatment plants, where they consume organic matter and produce electrons that are immediately taken up by other bacteria. Researchers have learned to harvest these electrons by letting the electroactive bacteria grow on the anodes of so-called microbial fuel cells; the electrons produced flow through the fuel cells to the devices' cathodes, generating current. In Ren's case, he combines these electroactive bacteria with a photoelectrochemical cell to split wastewater and generate hydrogen (Environ. Sci. Technol. 2017, DOI: 10.1021/acs.est.7b03644). In traditional water splitting, two half reactions take place: one that oxidizes H₂O into O₂ while generating hydrogen ions and electrons, and another that reduces those hydrogen ions into H₂. The process's efficiency tends to be limited by the first, oxygen-evolving half reaction—a thermodynamically unfavourable one that requires light or electrical power. Using wastewater sidesteps that half reaction because bacteria oxidise the organic solids in the wastewater to form CO₂, a more thermodynamically favourable process that requires less energy. This provides two benefits at once: avoiding a difficult reaction while actively removing waste, says Moritz Kuehnel, a chemist at Swansea University. Generating CO₂ at the anode is unavoidable, but Ren claims that the CO₂ could be sequestered or otherwise captured to further reduce the carbon footprint of this process. In a proof-of-concept experiment, Ren and his team set up a photoelectrochemical cell with a bioactive anode coated with a naturally occurring mix of electroactive bacteria and a photoactive gallium-indium cathode. When light shines on the cathode, excited electrons

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reduce hydrogen ions in the wastewater to form hydrogen, leaving positively charged holes. The holes are then filled with electrons from the anode, produced by the electroactive bacteria munching on the organic waste. The researchers are now trying to push their technologies toward commercialisation. Mohan claims that the full-scale digesters he is negotiating to build could produce hydrogen cost competitively with steam reforming of natural gas. A microbial photoelectrochemical device synthesises hydrogen from wastewater by using light to reduce hydrogen ions and bacteria to oxidise organic waste. Maness's team is working with a 5 L reactor on a bench top, actively trying to scale up. The process's efficiency is low, limited partly by the fact that solid lignocellulose makes the mixture viscous and difficult to stir. To overcome this problem, Maness is collaborating with scientists from Lawrence Berkeley National Laboratory to design a mixing reactor that can handle high amounts of solids. In addition to organic waste, other fast-growing waste streams like plastics could potentially be tapped for hydrogen and valuable chemicals, and researchers like Reisner and Kuehnel are developing the chemistry for doing so. A diversity of methods for making hydrogen, Maness says, is key for it to become successful as a fuel. Although the research still has a long way to go, Ren says the prospect of "killing two birds with one stone"—producing a clean fuel while treating waste—makes it worth the effort.

Chemical & Engineering News, 7 April 2019

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

Testing how well water disinfectants damage antibiotic resistance genes

2019-04-09

Each year at least 2 million Americans are infected with bacteria that cannot be treated with antibiotics, and at least 23,000 of these people die, according to the Centres for Disease Control. These bacteria can end up in our water, which is why we use disinfectants to kill or stop them from growing to treat both waste and drinking water. But so far, few researchers have looked at whether these treatments are effective in removing the genes that encode for the traits that make these bacteria resistant to antibiotics. Some researchers are concerned that, even after treatment, non-resistant bacteria could still become resistant by picking up intact genes left over from damaged antibiotic resistant bacteria. Although it's not clear if this is currently happening, researchers want to be prepared for this scenario. So, a team at the University of Washington tested how well current water and wastewater disinfection methods affect antibiotic

Each year at least 2 million Americans are infected with bacteria that cannot be treated with antibiotics, and at least 23,000 of these people die, according to the Centres for Disease Control.

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resistance genes in bacterial DNA. While these methods work well to deter bacterial growth, they had varied success in either degrading or deactivating a representative antibiotic resistance gene. The researchers recently published their results in the journal *Environmental Science & Technology* and are developing a model for proper treatment of any antibiotic resistance gene. "DNA is not in itself particularly toxic or harmful. But it's important to consider its fate once it's in the environment because it can potentially spread undesirable traits into bacterial communities," said corresponding author Michael Dodd, an associate professor in the UW's civil and environmental engineering department. "We have been finding more and more medically relevant antibiotic resistance genes in the environment. The recognition that these genes are present in the environment isn't new -- other groups have already provided a great deal of information on their behaviour as environmental contaminants. What's unique about our work is that we're focusing on really unravelling and characterising how a variety of disinfection processes influence the fate of such genes, so we can better understand how these different treatments affect antibiotic resistant bacteria and their DNA in our water." Current water treatment plants use a variety of disinfecting methods. Most involve exposing water to UV light or to chlorine- or oxygen-containing compounds, such as chlorine by itself or ozone. To determine how these methods affect both bacteria and antibiotic resistance genes, Dodd and his team used a model system: a harmless soil bacterium called *Bacillus subtilis*. The team worked with a strain of *B. subtilis* that overproduced a gene, called *blt*, which makes a protein that lets *B. subtilis* pump antibiotics out -- making the bacterium resistant to a variety of common antibiotics. The researchers exposed the bacteria to different disinfectant methods and then monitored two things: how well treated bacteria grew when exposed to antibiotics and whether the gene inside the bacteria was damaged. "As we expected, all of the treatments we looked at were successful in disrupting bacterial viability," said first author Huan He, a UW civil and environmental engineering doctoral student. "But we saw mixed results for DNA damage." At typical exposures used for water treatment, three methods showed greater than 90% degradation or deactivation of the gene: UV light, ozone and chlorine. The team determined that these three methods are largely successful in preventing the spread of antibiotic resistance by both deactivating the bacteria and damaging the resistance gene. But two other disinfectants called chlorine dioxide and monochloramine showed barely any damage to the gene. "We found that these two methods degrade DNA so slowly that almost nothing has happened during the amount of time water is exposed under typical treatment conditions," said He. "In fact, we found that DNA from bacteria

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Food Additive May Inhibit the Flu Vaccine

2019-04-10

New research in mice links a common food preservative to an altered immune response that possibly hinders flu vaccines. Tert-butylhydroquinone, or tBHQ, is found in several food products including cooking oils, frozen meats (especially fish), and processed foods like chips and crackers. Products don't always have to include the additive on ingredient lists. "If you get a vaccine, but part of the immune system doesn't learn to recognise and fight off virus-infected cells, then this can cause the vaccine to be less effective," says Robert Freeborn, a doctoral student at Michigan State University who led the study with Cheryl Rockwell, an associate professor in pharmacology and toxicology. "We determined that when tBHQ was introduced through the diet, it affected certain cells that are important in carrying out an appropriate immune response to the flu." Using various flu strains including H1N1 and H3N2, Freeborn and Rockwell focused on CD4 and CD8 T cells and incorporated tBHQ into the food of mice in an amount comparable to human consumption. "CD4 T cells are like movie directors that tell everyone else what to do," Freeborn says. "The CD8 T cells are the actors that do what the director wants." The researchers looked at several response factors including whether the T cells showed up, were able to do the right job, and ultimately recognise and remember the invading virus. "Overall, we saw a reduced number of CD8 T cells in the lung and a reduction in the number of CD4 and CD8 T cells that could identify the flu virus in the mice that were exposed to tBHQ," Freeborn says. "These mice also had widespread inflammation and mucus production in their lungs." tBHQ also slowed down the initial activation of T cells, reducing their ability to fight off an infection sooner. This allowed the virus to run rampant in the mice until the cells fully activated. A second phase of the study showed the additive hindered the immune system's ability to remember how to respond to the flu virus, particularly when another strain was introduced at another time. This resulted in a longer recovery and additional weight loss in the mice. "It's important for the body to be able to recognise a virus and remember how to effectively fight it off," Freeborn says. "That's the whole point of vaccines, to spur this memory and produce immunity. tBHQ seems to impair this process." The National Institutes of Health funded the work. The researchers presented the findings yesterday at the 2019 Experimental Biology meeting in Orlando, Florida.

New research in mice links a common food preservative to an altered immune response that possibly hinders flu vaccines.

Futurity, 8 April 2019

<http://www.futurity.org>

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Smart pyjamas could detect why you're not sleeping well

2019-04-10

The pyjamas you wear to bed may soon be able to tell how well you are sleeping. Trisha Andrew and her colleagues at the University of Massachusetts, Amherst, have developed a cotton pyjama shirt that has sensors for monitoring breathing, heartbeat and movement. The shirt can be used to monitor the wearer's sleep quality, such as the amount of REM sleep they are getting, which is thought to be important for consolidating memories, or if they have breathing issues during the night. Five lightweight sensors are sewn into the lining of the shirt. Four of the sensors detect constant pressure, like that of a body pressed against a bed. The fifth, positioned over the chest, senses rapid pressure changes, providing information about heart rate and breathing. The sensors are connected by wires made from thread thinly coated in silver. "They are sewed onto the seams of the shirt, so you don't see them," says Andrew. The shirt is fully machine-washable. Signals collected from the five patches are sent to a tiny circuit board that looks and functions like an ordinary pyjama button. The button has a built-in Bluetooth transmitter that sends the data wirelessly to a computer for analysis. The pyjama shirt is still in its early stages – it has been tested overnight on only eight people, and the team is still in the process of ensuring the sensors are accurate for a variety of body shapes and heights.

Andrew says the shirt cannot yet be used to diagnose medical issues, but the goal is to eventually replace lab-based sleep studies where participants are hooked up to various machines overnight. Instead, they could simply put on the pyjama top. The team is still in the process of ensuring that the sensors are accurate for a variety of body shapes. So far, they have tested the shirt on 35 people. They are now developing a full pyjama set that includes pants with built-in pressure detectors that sense the amount of stress on your back. The team presented the work at a meeting of the American Chemical Society this week.

New Scientist, 1 April 2019

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

DID YOU KNOW THESE THINGS HAD NAMES?

2019-04-10

1. The space between your eyebrows is called a glabella.

The pyjamas you wear to bed may soon be able to tell how well you are sleeping.

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2. The way it smells after the rain is called petrichor.
3. The plastic or metallic coating at the end of your shoelaces is called an aglet.
4. The rumbling of stomach is actually called a wamble.
5. The cry of a new born baby is called a vagitus.
6. The prongs on a fork are called tines.
7. The sheen or light that you see when you close your eyes and press your hands on them is called phosphenes.
8. The tiny plastic table placed in the middle of a pizza box is called a box tent.
9. The day after tomorrow is called overmorrow.
10. Your tiny toe or finger is called minimus.
11. The wired cage that holds the cork in a bottle of champagne is called an agraffe.
12. The 'na' and 'la', which don't really have any meaning in the lyrics of any song, are called vocables.
13. When you combine an exclamation mark with a question mark (like this ?!), it is referred to as an interrobang.
14. The space between your nostrils is called columella nasi.
15. The armhole in clothes, where the sleeves are sewn, is called armscye.
16. The condition of finding it difficult to get out of the bed in the morning is called dysania.
17. Unreadable hand -writing is called griffonage.
18. The dot over an "i" or a "j" is called tittle.
19. That utterly sick feeling you get after eating or drinking too much is called crapulence.
20. The metallic device used to measure your feet at the shoe store is called Bannock device.

How many of the above did you already know?

Pass this on, will you!

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Uncovering The Mechanisms Linking Air Pollution To Psychosis

2019-04-10

Let's start with just a few adjectives about our daily lives — overexposed, overwhelmed, stimulated, toxic, deficient. It's not enough that many young people lack good nutrition, but they are also challenged by circumstance by a lack of clean air to breathe and pure water to drink. I remember a news story I heard as a young woman that moulded my fears of chemicals for years, chemicals out of balance or mixed with the wrong toxins. The news reported a woman who came home from her hair dying appointment, cleaned her bathroom, and promptly died. The combination of chemicals freshly placed in her hair disagreed rather harshly in her body with whatever toxic chemicals she was using to clean the tile, mildew, bath, toilet, or floor. This was decades ago. Products may have improved. Still, I have never dyed my hair. All of these chemicals churning in our systems through daily exposure create hard work for the liver and lungs and affect every vital organ in the body. How could they not affect the brain? That incredible organ that serves the nervous system is affected as well by the hyper-stimulated nervous system. Throw some more chemicals and toxic inhalants that way and of course you are going to find the natural balance upset. Upsetting balance in the brain can be dramatic at times — it is different but similar to a physical shift where the diabetic person sees rapid change in blood sugar. Susan Scutti reports for CNN: "One of the most consistent findings over the past few decades has been a link between cities and psychosis," Dr. Joanne Newbury, lead author of the study and a postdoctoral researcher at King's College London, said. "Children who are born and raised in urban versus rural settings are almost twice as likely to develop psychosis in adulthood." Some other experts weigh in that more needs to be done beyond this one study, which has many variables. This study alone is a good beginning, but there is a need for more studies, more in-depth work, and varied consideration of the link. Regarding this initial study, the data came from more than 2,000 participants. All were born in England and Wales in 1994 and 1995. "Psychotic experiences were significantly more common among teens in the highest quartile of pollution exposure, even after the researchers accounted for factors that might also be linked to psychosis, such as cigarette smoking, cannabis dependence, and neighbourhood crime levels. "The teens exposed to top-quartile levels of nitrogen dioxide, nitrogen oxides and particulate matter (PM2.5, fine inhalable particles derived from chemical smoke) had 71%, 72% and 45% greater odds, respectively, of psychotic experiences compared with

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those exposed to the lowest-quartile levels." Note that for now it is an association between air pollution and psychosis — not a clearly direct cause and effect relationship. Other factors such as noise pollution are possible in denser populated areas — which can lead to interrupted sleep or disruption of restfulness, concentration, and focus. Fisher also considers that it is possible the gases and particles are causing brain inflammation. Earlier research suggests inflammation may be linked to psychosis. There simply needs to be more of this type of research. As they say, "Given that 70% of the world's population will be urban by 2050, uncovering the mechanisms linking the urban environment to psychosis and developing preventive interventions constitute an urgent health priority." Marianthi-Anna Kioumourtzoglou, an assistant professor in the Department of Environmental Health Sciences at the Columbia University Mailman School of Public Health, wrote in an editorial published beside the study that "air pollution exposures are ubiquitous in urban environments," yet they are "modifiable and can be reduced through rigorous regulatory action." "It is especially important to identify other factors that may potentially ameliorate the consequences of air pollution to protect human health," said Kioumourtzoglou, who had no role in the new research. "These could be lifestyle, nutritional, or neighbourhood-level factors."

Clean Technica, 7 April 2019

<https://cleantechnica.com>

Monsanto Spent \$17 Million in One Year to Discredit International Cancer Agency over Glyphosate Classification

2019-04-10

How badly did Monsanto want to discredit international cancer scientists who found the company's glyphosate herbicide to be a probable human carcinogen and promote a counter message of glyphosate safety instead? Badly enough to allocate about \$17 million for the mission, in just one year alone, according to evidence obtained by lawyers representing cancer victims suing Monsanto. That detail and others about the internal workings of Monsanto public relations operations have come to light in a Jan. 22 video-taped deposition of Monsanto executive Sam Murphey. Murphey's job at Monsanto included directing global media relations and "advocacy efforts in support of major litigation, policy matters, and reputational threats" involving the company's glyphosate-based herbicide business. And one of the biggest threats came from those

According to lawyers representing cancer victims suing Monsanto. The company spent \$17 million in one year to discredit international cancer scientists who found the company's glyphosate herbicide to be a probable human carcinogen.

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cancer scientists. Murphey now works for Bayer after the German company purchased Monsanto last summer. U.S. District judge Vince Chhabria did not allow Murphey's disclosure of the anti-IARC budget to be introduced into evidence in the *Hardeman V. Monsanto* trial, which reached a \$81 Million damages verdict last week. But the Murphey evidence is expected to be introduced at the *Pilliod V. Monsanto* trial that began last Thursday in Alameda County Superior Court in Oakland, California. It has been four years since the International Agency for Research on Cancer (IARC) reviewed the published and peer-reviewed scientific literature regarding glyphosate and found the herbicide to be probably carcinogenic, with a particular association to non-Hodgkin lymphoma. IARC is part of the World Health Organization and has classified over 1,000 substances as to their cancer hazard, typically without too much controversy. But glyphosate was different. Following the March 2015 classification, hundreds, and then thousands, of people diagnosed with non-Hodgkin lymphoma after exposures to Monsanto's herbicides filed suit against the agrochemical giant. Also, immediately after the IARC classification of glyphosate – and continuing to this day – the cancer scientists became the subject of sweeping condemnation from an assortment of organisations, individuals and even some U.S. lawmakers. They have been accused of operating not on sound science but on behalf of a political agenda, cherry-picking data, and promoting junk science, among other things. The criticisms have been magnified and repeated around the world in news articles, opinion pieces, blogs, Internet Google advertisements and more. Internal Monsanto documents that have surfaced through discovery for the more than 11,000 lawsuits filed against the company show that among other tactics, Monsanto has been secretly using third parties for its anti-IARC messaging because company executives and public relations agents thought the information would appear more credible coming from entities separate from Monsanto. In his deposition, Murphey was asked how much the company spent trying to cast doubt upon the IARC classification. Here is a bit of the exchange:

Plaintiff attorney Pedram Esfandiary: "So it's true that Monsanto's allocated millions of dollars in responding to the IARC classification, correct?"

Murphey: "We — we have — we had to spend a significant amount of resources, over several years now, correcting misinformation, and addressing questions in the public about — about glyphosate."

Esfandiary: "Has Monsanto allocated millions of dollars to responding to the IARC classification?"

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Murphey: "Yes."

Esfandiary: "Do you know roughly how much Monsanto allocated to it in 2016?"

Murphey: "I can only speak within the context of, you know, public affairs activities, you know, things that I would have been directly involved in. But in 2016, you know, I believe for some of the projects I was involved in, it was around 16 or 17 million."

Esfandiary: "\$16 or 17 million... was allocated to responding to the IARC clarification (stet)?"

Murphey: "No, not specifically and solely focused on IARC. It's — it would have focused on engagement and media relations and other activities on glyphosate, more generally."

Esfandiary then asked Murphey how much it would have cost the company to perform a long-term cancer bioassay test of its formulated glyphosate products, something the company has acknowledged it never did. Murphey said he did not know.

The year 2016 was a particularly critical time for Monsanto because in addition to facing litigation, the company's glyphosate license was up for renewal in Europe, and the U.S. Environmental Protection Agency was also reviewing glyphosate's registration.

How was the money spent?

In the deposition, Murphey was asked about a July 2015 internal Monsanto document called "IARC Follow Up" that cited a goal to "invalidate relevance of IARC" and "protect freedom to operate" (FTO). He was asked about a host of actions undertaken to minimize or discredit IARC's work that were laid out in that and other internal Monsanto communications. Several pages of the deposition are completely redacted, per court order, so it is not possible to see all of what was said by Murphey in his deposition. But here are a few examples of what was discussed:

Amplifying pro-glyphosate/Roundup messaging through "third-party channels." One example of using an outside party to parrot Monsanto talking points was an article that appeared on the Forbes contributor platform that appeared to be written by Henry Miller, who at the time was a fellow at the Hoover Institution at Stanford University. Internal Monsanto documents show the piece criticising IARC was actually drafted by Monsanto and sent to Miller with a request for him to publish the

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materials. Other Op-Ed manoeuvres. Just prior to the IARC classification, Monsanto executive Dan Goldstein discussed five “potential draft Op Eds he said he had written for “medical toxicologists to work from” that included “paragraphs on criticism of IARC.” Goldstein was emailing the draft opinion articles out to doctors and scientists with the hope that they would adopt the drafts as their own and have them published, the records show. Monsanto was available to “coordinate Op Ed versions” as needed, Murphey said in his deposition. “Let Nothing Go” strategy. According to Murphey, the initiative involved “carefully monitoring media coverage” with a focus on the European Union. “We had a number of markets we were — we were prioritising,” Murphey said. The project called for monitoring stories and highlighting or flagging those that contained what Monsanto saw as inaccurate information or misinformation about the company or its products, or stories that didn’t include the company’s perspective or point of view. Someone would then be assigned to follow up with those reporters, “proactively calling reporters in those instances, to share a statement, to provide some additional context, and to encourage those reporters to contact us in the future,” said Murphey. Convincing a Reuters reporter to write a story undermining the validity of the IARC classification was another example of Murphey’s work. Emails from within Monsanto showed that Murphey sent a slide deck of talking points and a suggested narrative to Reuters reporter Kate Kelland asking her to write a story that accused Aaron Blair, who was the chairman of the IARC working group on glyphosate, of concealing data that would have changed IARC’s conclusion on glyphosate. Murphey told Kelland in an April 2017 email that it was “vitally important information that needs to be reported.” He also told her to treat the information he sent her as “background,” meaning she should not mention she got the story idea and materials from Monsanto. Kelland then wrote the story Monsanto wanted. A deposition of Aaron Blair indicated the accusations laid out in the story were false, but Kelland did not include a copy of the deposition with her story. The story was promoted by Monsanto and chemical industry organizations and Google advertisements and was picked up and repeated by media outlets around the world. Murphey said in his deposition that he put no undue pressure on Kelland, and Monsanto believed the story to be valid and important. “Once I provided the initial information to — to Ms. Kelland, she was free to do with that information what she saw fit,” he said. “And the decision to investigate a story and ultimately — ultimately publish it was her decision, and the decision of her editors at Reuters.” Murphey said there was nothing nefarious in the efforts that Monsanto undertook after the IARC opinion was published. He said the company’s plan involved “engagement with third parties to provide information, share

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talking points, and other resources” along with “outreach to the media, to ensure balance and accuracy, and the right context and perspective on the science in — in their coverage of — of our product.” “As we moved forward, after the IARC classification, again, we were very forthright in engaging with agriculture groups, engaging with reporters, engaging on social media, to share - to share the company’s views,” Murphey said in the deposition. “We — you know, we kept our — we kept agriculture groups and others informed. We were pleased that many of them continued to speak out as well about what they saw as an inaccurate classification. But Monsanto was always very, again, I’ll just — very forthright in sharing our views about the classification.”

Sustainable Pulse, 1 April 2019

<https://sustainablepulse.com>

Concerns over glyphosate pass from human health to the soil

2019-04-10

When François Peaucellier talks about soil, he sounds like a sommelier. “It’s full of little leaves,” says the French farmer, holding up a clod from his field. “The earth is supple and beautiful. There is a surface life that is superb.” Peaucellier, who grows cereals and vegetables on a 200-hectare farm in the Hauts-de-France region north of Paris, is part of small but growing movement of farmers who are cutting back on pesticides not so much out of concerns for human health — but because they worry about what it does to the soil. Public attention on the risk of pesticides has focused on what chemicals like glyphosate do to human health. A U.S. federal jury recently ordered Germany’s Bayer to pay more than \$80 million to a man who claimed his cancer was caused by exposure to the weedkiller. But farmers like Peaucellier say the weedkiller’s impact on soil health has been overlooked, and represents a serious threat to Europe’s long-term food security. Soil experts, academics and scientific studies are also establishing clear links between the use of substances such as glyphosate with drops in soil fertility and the collapse of microbe ecosystems essential to healthy soil. With more than a third of the world’s land already degraded by erosion, compaction and chemical pollution, according to the U.N.’s Food and Agricultural Organization, thousands of farmers in countries like France are starting to embrace new methods. Peaucellier, 30, no longer measures success just by the bounty of his crops, he says, but by the number of worms he finds living in the soil beneath them. “Look at the rapeseed plants. Normally the plants should be twice as high as that,” he

Experts say the weedkiller’s impact on soil health represents a serious threat to Europe’s long-term food security.

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says, gazing at his neighbour's fields. He pierces his own land with a yellow spade. The soil is marbled with healthy decomposing roots, crawling lice and squirming earthworms. "These animals do so much more work than any fertiliser will do," he says. "But you need one, two, three years to bring back the life."

Disappearing earthworms

The European Union currently has no legal limit for the amount of glyphosate permitted in European soil, according to Vera Silva, a researcher for the soil physics and land management group at Wageningen University in the Netherlands. Silva has carried out extensive research into the prevalence of pesticide residues found in European soils. Though glyphosate can kill specific fungi and bacteria that plants need to suck up nutrients, "the effects of such a change are not completely understood yet," she says. Silva and other researchers at Wageningen University raised concerns about pesticide residues in a 2015 study, which looked at more than 300 samples of agricultural topsoil from across the EU. They found that four out of five samples contained at least one residue, and nearly three in five contained mixtures of chemicals. Little is known about the effects of mixtures. "The combined effects of residue mixtures need to be assessed," the study recommended. Another study from 2015 carried out by researchers from the University of Natural Resources and Life Sciences in Vienna also showed that casting activity of earthworms had nearly disappeared from the surface of farmland within three weeks of glyphosate application. Earthworms redistribute organic material in soil and are essential for soil fertility. The animals' reproductive activity fell by more than half, according to the same study. "These sizeable herbicide-induced impacts on agroecosystems are particularly worrisome because these herbicides have been globally used for decades," the study found. Beyond worms, the chemical appears to damage microbes that aid in plant decay, mineralization, and soil's vital carbon and nitrogen cycles. "Glyphosate can be present in some soil organisms," says Silva. "As soon as these organisms are affected, soil functions might be impaired."

Weighing the benefits, risks

Nearly 500 active substances are approved for use in pesticides in the EU, and European farms buy 374,000 tons of pesticides annually, according to Eurostat, the EU's statistical agency. Globally, 3 million tons of pesticides are used each year, generating about \$40 billion in revenue. Bayer, the world's largest producer of glyphosate, says that "precise application of glyphosate-based herbicides can allow farmers to leave the soil intact,"

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reducing tilling practices that release greenhouse gases and contribute to erosion. Pesticides companies also point out that users of pesticides should follow rules in the EU's Sustainable Use Directive, which requires farmers to be trained in their use. The directive also mandates that all chemical equipment be inspected, prohibits aerial spraying and limits pesticide use in sensitive areas. "Soil, like any resource, must be respected and protected," says Graeme Taylor, director of public affairs for the European Crop Protection Association, a lobby representing the pesticide industry. "The strong implementation of the Sustainable Use Directive is crucial in this respect." Taylor added that EU pesticide laws insist that pesticides undergo a soil risk assessment in which an acceptable concentration is defined. Even glyphosate-sceptics like Peaucellier acknowledge that farming without pesticides is difficult. Peaucellier still uses small amounts of glyphosate on his fields. To reduce his use further, he is experimenting with new strategies like conservation agriculture, a system that promotes permanent soil cover, no tillage and regular crop rotation as a way of improving biodiversity. Peaucellier's new farming practices go like this. Rather than leaving land fallow after a harvest, he immediately reseeds with a "cover crop" that's left to wilt. He crushes the cover plants with a roller, so they lie against the ground, helping prevent weeds. Soon they decompose and replenish the soil with nutrients. Last year Peaucellier began field tests comparing different cover crops and glyphosate doses on 30 strips of his own farmland. At the end of May he'll review the test plots with experts from the French National Institute for Agricultural Research, and evaluate the results. Peaucellier is one of 5,000 farmers in France to have adopted conservation agriculture techniques, he said. He is scheduled to travel to the National Assembly in Paris, to argue for conservation agriculture to be specifically subsidised as part of the EU's €59-billion-per-year Common Agricultural Policy. The national farming plan predominantly focuses on conventional farming methods. "The idea is to say to politicians 'help us to finance our cover crops rather than buying enormous machines that are useless,'" he says. "They don't understand that planting a seed can be useful to cover the soil, nourish the soil and avoid that carbon is released into the atmosphere." To illustrate his point, Peaucellier crosses the road to his neighbour's field and drives his shovel into the ground. The earth is hard, compact and resists his attempt to break it up. Underneath, the ground is hard, with no evidence of underground life. He points to a large crack — evidence of erosion. Pesticide residues had run off and contaminated a stream further down the valley, he says. "When it's sprayed on ... the degradation of the earth is

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much quicker," he says. "There's a real problem when we say we have to put in more to have more," he says.

Politico, 8 April 2019

<https://www.politico.eu>

Major study debunks myth that moderate drinking can be healthy

2019-04-10

Blood pressure and stroke risk rise steadily the more alcohol people drink, and previous claims that one or two drinks a day might protect against stroke are not true, according to the results of a major genetic study. The research, which used data from a 160,000-strong cohort of Chinese adults, many of whom are unable to drink alcohol due to genetic intolerance, found that people who drink moderately - consuming 10 to 20 grams of alcohol a day - raise their risk of stroke by 10 to 15 percent. For heavy drinkers, consuming four or more drinks a day, blood pressure rises significantly and the risk of stroke increases by around 35 percent, the study found. "The key message here is that, at least for stroke, there is no protective effect of moderate drinking," said Zhengming Chen, a professor at Oxford University's Nuffield Department of Population Health who co-led the research. "The genetic evidence shows the protective effect is not real." The World Health Organization (WHO) estimates that around 2.3 billion people worldwide drink alcohol, with average per person daily consumption at 33 grams of pure alcohol a day. That is roughly equivalent to two 150 ml glasses of wine, a large (750 ml) bottle of beer or two 40 ml shots of spirits. This latest study, published in The Lancet medical journal, focused on people of East Asian descent, many of whom have genetic variants that limit alcohol tolerance. Because the variants have specific and large effects on alcohol, but do not affect other lifestyle factors such as diet, smoking, economic status or education, they can be used by scientists to nail down causal effects of alcohol intake. "Using genetics is a novel way ... to sort out whether moderate drinking really is protective, or whether it's slightly harmful," said Iona Millwood, an epidemiologist at Oxford who co-led the study. "Our genetic analyses have helped us understand the cause-and-effect relationships." The research team - including scientists from Oxford and Peking universities and the Chinese Academy of Medical Sciences, said it would be impossible to do a study of this kind in Western populations, since almost no-one there has the relevant alcohol-intolerance gene variants. But the findings about the biological effects of alcohol should be the same for all people worldwide,

Previous claims that one or two drinks a day might protect against stroke are not true, according to the results of a major genetic study.

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they said. Europe has the highest per person alcohol consumption in the world, even though it has dropped by around 10 percent since 2010, the WHO says, and current trends point to a global rise in per capita consumption in the next 10 years.

Reuters Health, 5 April 2019

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

Scotland's HPV vaccine linked to 'near elimination' of cervical cancer

2019-04-10

The routine vaccination of schoolgirls against the human papillomavirus (HPV) in Scotland has led to a dramatic reduction in cervical cancer in later life. Some forms of the sexually-transmitted HPV are linked to cervical cancer – one of the most common cancers in women aged under 35 in the UK. A decade ago, the UK government introduced a UK-wide immunisation programme for girls aged 12 and 13. Compared with unvaccinated women born in 1988, vaccinated women born in 1995 and 1996 showed reductions of up to 90 per cent in cases of cervical intraepithelial neoplasia (CIN), a pre-cancerous abnormal growth of cells and lesions on the cervix linked to invasive cervical cancer. Unvaccinated women also showed a reduction in disease. The researchers say this suggests routinely vaccinating girls aged 12 and 13 in Scotland has created substantial "herd protection". The findings were made by Tim Palmer at the University of Edinburgh and his colleagues by analysing vaccination and screening records for 138,692 women born between 1988 and 1996, who had a screening test at age 20. The study's co-author, Kevin Pollock at Glasgow Caledonian University, says the HPV vaccine has exceeded expectations. "[The vaccine] is associated with near elimination of both low and high-grade cervical disease in young Scottish women eight years after the vaccine programme started." Cervical cancer cases in women in Scotland aged 20-24 have reduced by 69 per cent since 2012. Scotland's public health minister Joe FitzPatrick says the programme will be enlarged. "We are, of course, building on this success and extending the HPV vaccine programme to boys later this year."

New Scientist, 4 April 2019

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

The routine vaccination of schoolgirls against the human papillomavirus (HPV) in Scotland has led to a dramatic reduction in cervical cancer in later life.

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MDMA Might Be Able to “Reopen” a Part of The Brain That Closes After Puberty

2019-04-10

In the developing brain, there's a critical period of time when adolescents learn how to socialise. This critical period happens right around the point of sexual maturity in mice, according to research published in the journal *Nature*. But the scientists also found that they could re-open that window by giving adult mice a single dose of the drug MDMA — a finding that could point to new treatments for humans. After giving mice a dose of MDMA, the scientists found increased levels of oxytocin in the rodents' brains, along with the uptick in social behaviours — suggesting that brains are more flexible than scientists previously thought. “This suggests that we've reopened a critical period in mice, giving them the ability to learn social reward behaviours at a time when they are less inclined to engage in these behaviours,” Johns Hopkins scientist Gül Dölen told *Newsweek*. Right now, doctors are investigating MDMA as a potential treatment for post-traumatic stress disorder, as past studies have found that the drug, along with psychotherapy, has helped some people. Now, if this mouse study holds up in the human brain, scientists might know why. “As we develop new therapies or determine when to give these therapies, it's critical to know the biological mechanism on which they act,” Dölen said.

Science Alert, 7 April 2019

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

The UN Has Backed an Ambitious Plan For a Floating, Disaster-Proof City

2019-04-10

What once seemed like the moonshot vision of tech billionaires and idealistic architects could soon become a concrete solution to several of the world's most pressing challenges. At a United Nations roundtable recently, a group of builders, engineers, and architects debuted a concept for an affordable floating city. Unlike instances in the past when these futuristic designs have been met with scepticism, the executive director of the United Nations Human Settlement Programme (UN-Habitat), Maimunah Mohd Sharif, said the UN would support and shepherd this project to fruition. “Everybody on the team actually wants to get this built,” said Marc Collins, the CEO of Oceanix, a company that builds floating structures. “We're not just theorising.” The company believes a floating city project would address both dire housing shortages and threats

Researchers have found that a single dose of the drug MDMA can re-open the part of the brain responsible for learning to socialise.

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from rising sea levels. The structures themselves would be designed to withstand all sorts of natural disasters, including floods, tsunamis, and Category 5 hurricanes. The concept, known as Oceanix City, was designed by renowned architect Bjarke Ingels in collaboration with Oceanix. Though it still needs funding, it's essentially a toolkit for investors brave enough to take on the project. The city would essentially be a collection of hexagonal platforms that can each hold around 300 residents. Hexagons are widely considered one of the most efficient architectural shapes. (Think of the orderly inside of a beehive.) By designing each platform as a hexagon, the builders hope to minimise their use of materials. The designers consider a group of six platforms to be a "village." The entire city would contain six villages, for a total of around 10,000 residents. The villages wouldn't allow any high-emitting cars or trucks. The city would not contain any garbage trucks. Instead, pneumatic trash tubes would transport garbage to a sorting station, where it could be identified and repurposed. "This doesn't look like Manhattan," Collins told the UN. "There are no cars." The design might allow for driverless vehicles, however, and the city could experiment with new technologies such as drone deliveries. The concept calls for "ocean farming," which would involve growing food beneath the surface of the water. Cages underneath the platforms could harvest scallops, kelp, or other forms of seafood. Aquaponic systems would use waste from fish to help fertilise plants, while vertical farms would generate year-round produce. Both of these technologies could also help the city remain self-sufficient during a hurricane or other natural disaster. Overall, the goal is to reduce waste and produce all the food necessary to feed the city's inhabitants. Though it's referred to as a "floating city," the community would actually be moored to the ocean floor. Oceanix envisions the villages within about a mile of major coastal cities. The platforms could also be towed to safer locations in the event of a disaster. The platforms would be bolstered by Biorock, a material created by exposing underwater minerals to an electric current. This leads to the formation of a limestone coating that's three times harder than concrete, but can still be made to float. The substance becomes stronger with age and can even repair itself as long as it's still exposed to the current. This allows it to withstand harsh weather conditions. The city could also contain an aquifer system that pulls clean water out of the air. "Cities really start and fail by how well they manage water," engineer Bry Sarté told the UN. In a disaster scenario, machine generators could pull air from the atmosphere, condense it into water, and filter it for impurities like metal or bacteria. The city would not contain any high-rises. To keep a low centre of gravity, buildings would be between four and seven stories. In addition to homes, the city would feature a spiritual centre, cultural centre, and communal library,

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where residents could rent computers and bicycles as well as books. All buildings would be constructed out of sustainable materials like timber and bamboo. They're also designed to be disassembled so that future generations of architects can reconfigure the concept. The designers recognise, of course, that most people will continue to live on land in the future. Ingels referred to his vision for the city as "utopian pragmatism" – the idea that we can accomplish grand design feats in concrete, practical ways. Not everyone would be amenable to living on water, of course, but those who can't afford high rents in major cities or who want a living situation that's less vulnerable to natural disasters could benefit from the concept. Floating homes might even have a calming effect. Ingels said he lives on a decommissioned ferry, and the rocking helps lull his son to sleep. People would "never sleep better than they [would] on a floating island," he said. Pulling off a floating city concept is difficult, but within reach. It's somewhat akin to landing on the Moon. "I see this, in many ways, as our Apollo 10 dress rehearsal," Victor Kisob, the deputy executive director of UN-Habitat, told the roundtable. This vision was shared by many of the project's designers, including Ingels. "This is essentially about exploration," he told Business Insider. "It's going to serve as an amazing prototype experiment for some of the challenges you're going to face on Mars."

Science Alert, 7 April 2019

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

Moderate muscle strength tied to lower risk of diabetes

2019-04-10

Maintaining a moderate amount of muscle strength may help adults lower their risk of developing type 2 diabetes, a U.S. study suggests. Researchers asked 4,681 people without diabetes, whose average age was 43, to do leg and bench presses to measure their muscle strength, and to perform treadmill tests to assess their cardiorespiratory fitness. During an average follow-up period of more than eight years, 229 participants, or almost 5 percent, developed diabetes. Compared to people who scored lowest on muscle strength tests at the start of the study period, those with moderate muscle strength were 32 percent less likely to develop diabetes. Higher levels of muscle strength, however, didn't appear to impact future diabetes risk. "You don't need to be the Hulk to help reduce your risk of diabetes," said study co-author Dr. Angelique Brellenthin of Iowa State University in Ames. "Performing even a small amount of resistance training, which is a main contributor to muscular strength, may provide big benefits," Brellenthin said by email. "Bodyweight squats,

Maintaining a moderate amount of muscle strength may help adults lower their risk of developing type 2 diabetes, a U.S.

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lunge, push-ups and planks are great for beginners." The study focused on type 2 diabetes, the most common form of the disease, which is linked to obesity and aging and happens when the body can't properly use or make enough of the hormone insulin to convert blood sugar into energy. Moderate muscle strength was associated with a lower risk of diabetes even after researchers accounted for a person's aerobic fitness levels as well as risk factors that can contribute to diabetes risk, such as family history, smoking, drinking, obesity and high blood pressure, researchers report in Mayo Clinic Proceedings. Before adjusting for these other factors, people with high muscle strength did have a somewhat lower diabetes risk compared to the weakest participants. But after accounting for these factors, that advantage disappeared. "Muscles are highly metabolically active and high users of glucose," or blood sugar, said Dr. Tahseen Chowdhury of Royal London Hospital in the UK. "Greater muscle mass and volume will tend to use more glucose, but also tend to be more sensitive to the effects of insulin which increase muscle uptake of glucose," Chowdhury, who wasn't involved in the study, said by email. The study wasn't a controlled experiment designed to prove whether or how muscle strength might directly impact the development of diabetes. It also wasn't designed to determine which types of workout might be best for diabetes prevention. "The best way to prevent diabetes is to avoid a high-calorie diet and to have regular aerobic physical activity at moderate to high intensity for at least 30 minutes for 5 to 6 days a week," said Dr. Stefano Volpato of the University of Ferrara in Italy. "Resistance training exercises are useful to increase muscle mass, but results of this study are too preliminary to recommend this type of intervention to prevent diabetes," Volpato, who wasn't involved in the study, said by email. Because the risk of diabetes increases with age, it's possible that results would look different for adults over 65, said Dr. Alan Sinclair, director of the Foundation for Diabetes Research in Older People at Diabetes Frail Ltd and a visiting chair in diabetes care at Kings College London. "The study would have been more interesting and relevant if the mean age of subjects was over 65 years where lowered muscle strength means much more than diabetes risk – it also means something about walking ability, risk of falls, risk of frailty, and loss of independence," Sinclair, who wasn't involved in the study, said by email. Even so, "the study emphasizes the importance that maintaining a moderate degree of muscle strength can provide some protective value against diabetes developing," Sinclair said.

Reuters Health, 4 April 2019

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

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Nutrients from food, not supplements, linked to lower risks of death, cancer

2019-04-10

Adequate intake of certain nutrients is associated with a reduction in all-cause mortality when the nutrient source is foods, but not supplements, according to a new study. There was no association between dietary supplement use and a lower risk of death. In addition, excess calcium intake was linked to an increased risk of cancer death, which the researchers found was associated with supplemental doses of calcium exceeding 1,000 mg/day. The study was published on April 9 in *Annals of Internal Medicine*. "As potential benefits and harms of supplement use continue to be studied, some studies have found associations between excess nutrient intake and adverse outcomes, including increased risk of certain cancers," said Fang Zhang, M.D., Ph.D., associate professor at the Friedman School of Nutrition Science and Policy at Tufts University and senior and corresponding author on the study. "It is important to understand the role that the nutrient and its source might play in health outcomes, particularly if the effect might not be beneficial." The study used a nationally representative sample comprised of data from more than 27,000 U.S. adults ages 20 and older to evaluate the association between dietary supplement use and death from all causes, cardiovascular disease (CVD), and cancer. The researchers assessed whether adequate or excess nutrient intake was associated with death and whether intake from food versus supplement sources had any effect on the associations. For the association between nutrient intake and the risk of death, the researchers found:

- Adequate intakes of vitamin K and magnesium were associated with a lower risk of death;
- Adequate intakes of vitamin A, vitamin K, and zinc were associated with a lower risk of death from CVD; and
- Excess intake of calcium was associated with higher risk of death from cancer.

When sources of nutrient intake (food vs. supplement) were evaluated, the researchers found:

- The lower risk of death associated with adequate nutrient intakes of vitamin K and magnesium was limited to nutrients from foods, not from supplements;

Researchers from the Friedman School of Nutrition Science and Policy at Tufts have found that adequate intake of certain nutrients from foods -- but not supplements -- is linked to a reduction in all-cause mortality.

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- The lower risk of death from CVD associated with adequate intakes of vitamin A, vitamin K, and zinc was limited to nutrients from foods, not from supplements; and
- Calcium intake from supplement totals of at least 1,000 mg/day was associated with increased risk of death from cancer but there was no association for calcium intake from foods.

In addition, the researchers found that dietary supplements had no effect on the risk of death in individuals with low nutrient intake. Instead, the team found indications that use of vitamin D supplements by individuals with no sign of vitamin D deficiency may be associated with an increased risk of death from all causes including cancer. Further research on this potential connection is needed. "Our results support the idea that, while supplement use contributes to an increased level of total nutrient intake, there are beneficial associations with nutrients from foods that aren't seen with supplements," said Zhang. "This study also confirms the importance of identifying the nutrient source when evaluating mortality outcomes." The study used 24-hour diet recall data from six two-year cycles of the National Health and Nutrition Examination Survey, through 2010. For each nutrient, the daily supplement dose was calculated by combining the frequency with the product information for ingredient, amount of ingredient per serving, and ingredient unit. Dietary intake of nutrients from foods was assessed using 24-hour dietary recalls. Mortality outcomes were obtained for each participant through linkage to the National Death Index through December 31, 2011, using a probabilistic match. The authors note some limitations, including the duration of dietary supplement use studied. In addition, prevalence and dosage of dietary supplement use was self-reported and so is subject to recall bias. Residual confounding may play a role in the observed associations.

Medical Xpress, 8 April 2019

<http://medicalxpress.com>

Too much of a good thing? High doses of vitamin D can lead to kidney failure

2019-04-10

A 54-year-old man, after returning from a trip to Southeast Asia where he spent much of his holiday sunbathing, showed increased levels of creatinine, suggesting kidney damage or malfunction. After referral to a kidney specialist and further testing, it was discovered that he had been prescribed high doses of vitamin D by a naturopath, who recommended

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a dose of 8 drops every day. Over 2 ½ years, the patient, who did not have a history of bone loss or vitamin D deficiency, took 8-12 drops of vitamin D daily, totalling 8000-12,000 IU. As a result, he had very high levels of calcium in the blood, which left him with significant kidney damage.

“Although vitamin D toxicity is rare owing to a large therapeutic range, its widespread availability in various over-the-counter formulations may pose a substantial risk to uninformed patients,” writes Dr. Bourne Auguste, a Clinical Fellow in Home Dialysis at Toronto General Hospital and the University of Toronto. The recommended daily allowance is 400-1000 IU, with 800-2000 IU recommended for adults at high-risk of osteoporosis and for older adults. “Our experience informs us that patients and clinicians should be better informed about the risks regarding the unfettered use of vitamin D. Given new findings from the US Preventive Services Task Force, current Canadian guidelines regarding its use in low-risk individuals should be revisited,” the authors suggest. “Use of vitamin D drops leading to kidney failure in a 54-year-old man” is published April 8, 2019.

Science Daily, 8 April 2019

<http://www.sciencedaily.com>

Could eating garlic reduce aging-related memory problems?

2019-04-10

Consuming garlic helps counteract age-related changes in gut bacteria associated with memory problems, according to a new study conducted with mice. The benefit comes from allyl sulfide, a compound in garlic known for its health benefits. “Our findings suggest that dietary administration of garlic containing allyl sulfide could help maintain healthy gut microorganisms and improve cognitive health in the elderly,” said Jyotirmaya Behera, Ph.D., who lead the research team with Neetu Tyagi, Ph.D., both from University of Louisville. Behera will present the research at the American Physiological Society’s annual meeting during the 2019 Experimental Biology meeting to be held April 6-9 in Orlando, Fla. The gut contains trillions of microorganisms collectively referred to as the gut microbiota. Although many studies have shown the importance of these microorganisms in maintaining human health, less is known about health effects linked to gut microbiota changes that come with age. “The diversity of the gut microbiota is diminished in elderly people, a life stage when neurodegenerative diseases such as Alzheimer’s and Parkinson’s develop and memory and cognitive abilities can decline,” said Tyagi. “We want to better understand how changes in the gut microbiota

Oral allyl sulfide administration reduces the age-related memory problem through restoration gut bacteria in the intestine

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relate to aging-associated cognitive decline.” For the study, the researchers gave oral allyl sulfide to mice that were 24 months old, which correlates to people between 56 and 69 years of age. They compared these mice with 4- and 24-month-old mice not receiving the dietary allyl sulfide supplement. The researchers observed that the older mice receiving the garlic compound showed better long- and short-term memory and healthier gut bacteria than the older mice that didn’t receive the treatment. Spatial memory was also impaired in the 24-month-old mice not receiving allyl sulfide. Additional experiments revealed that reduced gene expression of neuronal-derived natriuretic factor (NDF) in the brain was likely responsible for the cognitive decline. This gene was recently discovered by the University of Louisville researchers and is required for long-term and short-term memory consolidation. The researchers found that mice receiving the garlic compound exhibited higher levels of NDF gene expression. In addition, recombinant-NDF protein therapy in the brain restored the cognitive abilities of the older mice that did not receive the garlic compound. The researchers also found that oral allyl sulfide administration produces hydrogen sulfide gas—a messenger molecule that prevents intestinal inflammation—in the gut lumen. Overall, the new findings suggest that dietary allyl sulfide promotes memory consolidation by restoring gut bacteria. The researchers are continuing to conduct experiments aimed at better understanding the relationship between the gut microbiota and cognitive decline and are examining how garlic might be used as a treatment in the aging human population.

Medical Xpress, 8 April 2019

<http://medicalxpress.com>

How a New Cancer ‘Vaccine’ Fights Tumours Throughout the Body

2019-04-10

A new cancer “vaccine” that’s injected directly into a single tumour can trigger the immune system to attack cancer cells throughout the body, a small new study suggests. The researchers say that the experimental therapy essentially turns tumours into “cancer vaccine factories,” where immune cells learn to recognise the cancer before seeking it out and destroying it in other parts of the body. “[We’re] seeing tumours all throughout the body melting away” after injecting just one tumour, said lead study author Dr. Joshua Brody, director of the Lymphoma Immunotherapy Program at the Icahn School of Medicine at Mount Sinai in New York. Still, the research, published in the journal *Nature Medicine*,

A new cancer “vaccine” that’s injected directly into a single tumour can trigger the immune system to attack cancer cells throughout the body, a small new study suggests.

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is very preliminary. The therapy has only been tested in 11 patients with non-Hodgkin's lymphoma (a cancer of immune system cells), and not all of these patients responded to the treatment. But some patients did have remission for relatively long periods, and the results were promising enough that the therapy is now also being tested in patients with breast and head and neck cancers, the authors said. What's more, the "vaccine" appears to substantially boost the effectiveness of another type of immunotherapy called "checkpoint blockade" — the same therapy that former President Jimmy Carter received to treat his metastatic melanoma in 2015. ("Immunotherapy" refers to treatments that harness the immune system to fight cancer.) The two therapies "are remarkably synergistic," Brody told Live Science. So far, the researchers have only tested the combined therapies in mice, but they are optimistic that the combined therapies could benefit cancer patients, particularly those that aren't getting much benefit from current immunotherapy treatments.

Cancer "vaccine"

To be clear, the new treatment is not technically a vaccine — a term used for substances that provide long-lasting immunity against disease. (Still, the term "cancer vaccine" can be used to refer to therapies that train the immune system to fight cancer, according to the American Cancer Society.) Instead, the new treatment is a type of immunotherapy. It involves giving patients a series of injections with two types of immune stimulants. The therapy has three steps. First, patients are given an injection that contains a small molecule that recruits immune cells, called dendritic cells, into the tumour. Dendritic cells act like generals in an army, telling the immune system "soldiers" — known as T cells — what to do, Brody said. Next, patients are given a low dose of radiotherapy, which kills a few tumour cells so that they spill out "antigens," or proteins, that the immune system can learn to recognise, Brody said. Dendritic cells then take up these antigens and show them to the T cells. Then, patients are given a second injection that contains a molecule that activates the dendritic cells. "The dendritic cells are learning the lesson ... and telling it to the T cells," which then can search the body for other cancer cells, Brody said.

Synergistic therapies?

In the new study, many of the 11 lymphoma patients saw a regression of their tumours that lasted for months to years. But several patients didn't benefit from the therapy. The researchers were also interested to see how their therapy worked with checkpoint blockade drugs, which essentially

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take the “brakes” off T cells so they better attack cancer cells. While this therapy can work well for some types of cancer (indeed, President Carter had complete remission after his checkpoint blockade treatment), it doesn’t work well for others, including non-Hodgkin’s lymphoma. When the researchers gave checkpoint blockade drugs to mice with non-Hodgkin’s lymphoma, the treatment, not surprisingly, had no effect. But when they gave it in combination with their vaccine, about 75% of the mice went into long-term remission. The type of therapy tested in the new study is known as “in situ vaccination,” because it involves injections directly into tumour cells. It isn’t the first experimental “in situ” cancer vaccine — in 2018, researchers reported promising results of another in situ vaccine in mice. But the new treatment is different because it focuses on dendritic cells rather than T cells. The authors think “this could be ... effective for many cancer types that are so far not benefiting much from cancer immunotherapy,” Brody said. Dr. Mark Mulligan, director of the NYU Langone Vaccine Centre, who wasn’t involved with the study, said the new findings appear promising. Figuring out how to harness checkpoint blockade drugs for more cancer types “is an important area of ongoing research,” Mulligan told Live Science. The data presented in mice, and early data from the human trial, “appear promising” in terms of enhancing the effect of checkpoint blockade treatments, he said. Still, Mulligan cautioned that the new study is the “earliest phase” of human testing, and that larger, more rigorous studies will now be needed to confirm the methods’ safety and effectiveness. Dr. Pallawi Torika, an assistant professor of oncology at Roswell Park Comprehensive Cancer Centre in Buffalo, New York, who specialises in lymphoma, agreed the results are “preliminary yet promising.” New immunotherapy approaches for treating non-Hodgkin’s lymphomas are “sorely needed,” said Torika, who was not involved with the new research. The effectiveness of the study approach is “welcome news,” especially given the dramatic improvement seen in the mouse study when the treatment was combined with checkpoint blockade, she told Live Science. But Torika noted that the treatment approach used in the study is “quite cumbersome.” Patients received nine daily injections of the first immune stimulant, followed by two doses of radiotherapy, and then eight injections of the second immune stimulant. “The next set of experiments will need to focus on simplifying, combining and reducing the number of steps needed” so that the approach could be tested at a number of medical sites, rather than a few specialised cancer centres, Torika said.

Live Science, 8 April 2019

<http://www.livescience.com>

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How Whole Grains Could Help Your Liver

2019-04-10

Eating whole grains and cereal may reduce the risk of liver cancer. That's according to findings presented at the annual meeting of the American Association for Cancer Research (AACR). Eating a diet rich in whole grains and dietary fibre has been linked to numerous health benefits, including a lower risk of insulin resistance, high insulin levels in the blood and inflammation in the body — all of which are risk factors for hepatocellular carcinoma, the most common type of liver cancer. With that in mind, a group of researchers decided to see if there was an association between eating more grains and fibre and the risk of liver cancer. To do so, they used two large U.S. data sets: the Nurses' Health Study, which began in 1976 and comprised of all women, and the Health Professionals Follow-Up Study, an all-male study that began in 1986. Every four years or so for up to 32 years, study participants filled out a questionnaire about their dietary habits. During that time span, 141 of the more than 125,000 participants were diagnosed with hepatocellular carcinoma. "We observed that a higher whole grain intake was associated with lower hepatocellular carcinoma risk," compared with a lower whole grain intake, senior study author Dr. Xuehong Zhang, an assistant professor of medicine at Harvard Medical School and an associate epidemiologist at Brigham and Women's Hospital in Boston, said during a talk about the research. But the researchers also found that certain parts of a whole grain might be associated with a reduced risk, Zhang added. A whole grain is a seed that is made up of three main parts: The bran, which is the outer layer; the endosperm, which is the middle layer; and the germ, which is the core of the seed. Refined grains, such as white flour, white bread and white rice are whole grains that have been processed to remove the bran and germ. What's left — the endosperm — has some proteins and vitamins, however, it's mostly made up of starchy carbohydrates. The bran and germ, on the other hand, contain important nutrients such as vitamins, minerals, phytochemicals and healthy fats, Zhang said. The researchers found that, compared with eating lower amounts of bran, eating higher amounts of bran specifically was associated with a lower risk of hepatocellular carcinoma (but this finding didn't reach statistical significance). However, they found no association for eating higher amounts of germ. They also found that eating more cereal fibre was associated with a lower risk of the cancer, compared with lower amounts of cereal fibre (again, this finding didn't reach statistical significance). But they found no association with eating more fruits or vegetables, which also contain fibre. Because hepatitis infections are a risk factor for liver cancer, the researchers also

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examined what happened when they excluded people who had hepatitis from their results and found similar associations. However, Zhang noted several limitations of the study: the researchers didn't have hepatitis infection information for some people, and because the data was collected with surveys, the data could have been incorrect. Furthermore, 95 percent of the study population was white. "Whether the result can be generalizable to other groups requests further investigation," he said. The findings have not yet been published in a peer-reviewed journal.

Live Science, 4 April 2019

<http://www.livescience.com>

Study reveals why heart failure patients suffer depression, impaired thinking

2019-04-10

A new study by University of Guelph researchers explains why and points to ways to prevent and treat both heart and brain maladies through the emerging field of circadian medicine. Published recently in Nature's Scientific Reports, the study is the first to reveal how cognition and mood in mice are regulated by the body clock and how pertinent brain regions are impaired in heart failure, said Tami Martino, a professor in U of G's Department of Biomedical Sciences and director of the Centre for Cardiovascular Investigations. "Neurosurgeons always look in the brain; cardiologists always look in the heart. This new study looked at both," said Martino, whose work in the emerging field of circadian medicine is supported by funding from the Canadian Institutes of Health Research. She recently received a Mid-Career Investigator Award from the Heart and Stroke Foundation of Canada. Coronary heart disease, the most common cause of heart failure, causes one in three deaths in Canada, according to the Heart and Stroke Foundation. Human patients with heart failure often have neurological conditions such as cognitive impairment and depression, said Martino. She worked on the study with master's student Austin Duong and Ph.D. student Cristine Reitz—both co-first authors—and neuroscientists including U of G psychology professor Boyer Winters and biomedical sciences professor Craig Bailey. Martino suspected the heart-brain connection involved the circadian mechanism molecule, called "clock." Circadian rhythms in humans and other organisms follow Earth's 24-hour cycle of light and darkness, signalling when to sleep and when to be awake. Martino's earlier research showed how disrupting circadian rhythms—as with shift workers, jet-lagged travellers and patients disturbed in intensive-care units—can trigger changes that worsen heart

Heart failure patients often have trouble with thinking and depression.

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disease and impair overall health and well-being. For this new study, the researchers compared normal mice with mice carrying a mutation in their circadian mechanism (called "clock mice"). They found that the mutation affected the structure of neurons in brain areas important for cognition and mood. Working with University of Toronto colleagues, the team also found differences in clock regulation of blood vessels in the brains of the clock mice. After inducing heart failure in mice to simulate human heart failure, they used microarray profiling to identify key genes in the brain that were altered in neural growth, stress and metabolism pathways. The results show that the circadian mechanism influences neural effects of heart failure, said Martino. Pointing out that no cure exists for the heart condition, she said understanding how the circadian mechanism works in the brain may lead to new strategies to improve patients' quality of life. Patients recovering from heart attacks often experience disturbed circadian rhythms from light, noise and interactions with hospital staff at night. "Maintaining circadian rhythms especially for patients with heart disease could lead to better health outcomes." More generally, the findings point to potential health benefits for people in general. Avoiding shift work for people with underlying heart conditions or sleep disorders, reducing light at night or avoiding social jet lag (going to bed late and waking up later than usual on weekends) could all help reduce neurobiological impairments. Those problems—and potential solutions—involve not just hearts but brains, she said. "If we're not yet able to cure heart failure, we should at least be focusing on how we can improve quality of life for patients."

Medical Xpress, 5 April 2019

<http://medicalxpress.com>

Skin cancer: Missing eyelids when using SPF moisturiser a 'risk'

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Failing to apply moisturiser with sun protection factor (SPF) and sunscreen properly to the face, particularly around eyes, could be putting people at risk of skin cancer, a study suggests. Researchers found differences in the way people applied sunscreen and SPF moisturiser. More skin is missed with moisturiser - especially the eyelids, where the skin is thin and more vulnerable to cancer. Sunglasses with UV filters can help protect missed areas, the experts said. Many moisturisers are sold with SPF of 30-50, similar to the level of traditional sunscreens, but they are not intended to be a replacement for sunscreen if spending long periods of time outdoors

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in the summer. The research team at the University of Liverpool studied how 84 people (62 women and 22 men) put on both moisturiser and sunscreen, then took photos with a UV-sensitive camera showing how well they had covered their faces. The researchers found that nearly 17% of the face was missed with SPF moisturiser compared with 11% for sunscreen. And there was 21% lower coverage of the area around the eyelids with moisturiser and 14% with sunscreen, the study in PLOS One found. These are the area's most vulnerable to skin cancer, but people were unaware they had not covered them, said Austin McCormick, study author and consultant ophthalmic and oculoplastic surgeon, from Aintree University Hospital Trust. "The eyelid skin is very thin and this puts it at risk of UV damage," he said. "The area around the eyelashes and between the eyelids and the nose is least likely to be covered." Mr McCormick said that eyelid cancers accounted for 10% of all basal cell carcinomas in the UK, the most common type of skin cancer, so people should pay particular attention to the eyelid area when putting on any SPF cream.

'SPF is better than none'

Moisturiser may be used more sparingly because it is often expensive, sold in smaller amounts and is seen as a "precious cream", he said. "If planning prolonged sun exposure, we advise sunscreen be used. "If using moisturiser, we advise one with SPF: any SPF is better than none, but it should not be considered the equal of sunscreen," Mr McCormick said. Holly Barber, from the British Association of Dermatologists, said the formulas in SPF moisturisers were less likely to be rub-resistant and water-resistant if applied more thinly. But she said it was surprising that people were not more hesitant to apply sunscreen around the eyes - because it can make them sting. "A good way to avoid problems such as sunburn in areas missed when applying sun protection is to make use of protective clothing such as sun hats and sunglasses, as well as reapplying regularly," she said. Sunscreen is really only necessary when planning to spend half an hour or more in summer sunshine. If you are just popping out at lunchtime it is unlikely that you will need sunscreen, especially if you applied a moisturiser with SPF that morning or are in and out of the shade of buildings and trees.

What are moisturisers with SPF for?

They are fine for offering some protection if you are going out briefly. But if you intend spending some time outdoors, especially between April and September, then sunscreens are much more effective. Moisturisers

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providing SPF do not bind as well to the skin as sunscreen, and so are not intended to provide adequate protection for extended periods in the sun.

Is sun protection needed all year round in the UK?

In the winter months, UV protection in the UK is not necessary - except in people who are abnormally sensitive to sunlight. We all need some sun exposure, which provides us with important vitamin D. However, this has to be balanced with the risk of skin damage in hotter months. This is not directly related to how hot it is, but to the UV index. Although this is generally higher on cloudless, hot days than on cloudy, cool days, you should not rely on temperature alone as a guide to the need for sun protection.

BBC News, 4 April 2019

<http://news.bbc.co.uk>

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