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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

Spray drift management

2019-07-26

The possibility of off-target spray drift accompanying the application of pesticides is a concern both to the community and the agricultural industry, for whom it is a constant challenge to find ways to minimise it more effectively. The Australian Pesticides and Veterinary Medicine Authority (APVMA) is responsible for ensuring that off-target pesticide spray drift does not harm human health, the environment or Australia's international trade. From 2010 to 2019 the APVMA implemented a policy known as the Operating Principles in Relation to Spray Drift Risk. This policy had some limitations, including a lack of flexibility and ability to adopt newer systems/technologies to reduce the risk of spray drift. The risk assessments supporting the approval of pesticide products was based on worst case scenarios and provided little incentive for spray applicators to adopt best practice, new technology and/or operations that will limit spray drift. The APVMA therefore began a project in 2013 to develop a new spray drift regulatory approach that will enable users to potentially reduce buffer zones. Two rounds of public consultation were undertaken on the new APVMA approach to spray drift management. This policy was implemented on 19 July 2019. The following documents and files all form part of the spray drift management approach.

- Spray drift risk operating principles: describes the methods and scientific principles the APVMA uses to assess and manage spray drift issues
- Spray drift risk assessment manual (SDRAM): overarching document that describes the spray drift approach and its elements
- Labelling requirements: from the Agricultural Labelling Code (these replicate the requirements set out in the SDRAM)
- Definitions: for terms used on the product label
- Spray drift risk assessment tool (SDRAT): used by the APVMA to conduct a risk assessment of the realistic worst-case scenario for the use of each product to generate buffers for different sensitive areas. The tool will generate the wording to appear on the product label. The tool will also be available to applicants to conduct self-assessments prior to submitting an application
- Spray drift management tool (SDMT): used by the APVMA for assessing DRTs

The APVMA began a project in 2013 to develop a new spray drift regulatory approach which was implemented on 19 July 2019.

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- Spray drift data guidelines (SDDG): describes how information and data related to spray drift management (spray drift data) may be generated and submitted
- Standard scenarios: AGDISP input files used for realistic worst case scenarios for boom sprayer, fixed wing and helicopter. Output from these scenarios is used in the SDRAT
- Droplet size distributions (DSD): standard APVMA spectra used to determine boundaries for Fine, Medium, Coarse, Very Coarse, Extremely Coarse and Ultra Coarse droplet size classifications. These can be imported into AGDISP
- DSD converter: ensures that droplet size distributions from different testing facilities can be compared and be consistent relative to the APVMA DSD
- Spray drift factsheet: July 2019 edition.

Overview of the spray drift management approach

Under the spray drift management approach, there are no changes to the current items and modules for registration applications. Applicants will continue to submit relevant information packages to allow the regulatory acceptable levels (RAL) to be determined. The method used to determine the RAL is described in chapter three of the SDRAM. Standard deposition curves (outlined in chapter four of the SDRAM and scenario files) will be used to determine buffer zones based on realistic worst-case scenarios. Applicants will also have an option to provide information to determine custom deposition curves. The SDDG describe how spray drift information and data may be generated and submitted. The approved RAL and deposition curve would be entered into the SDRAT that is described in chapter six of the SDRAM. The SDRAT contains approved label instructions (chapter five of the SDRAM) and will be used to generate the label instructions, including buffer zones and spray drift restraints. The SDMT will be used by the APVMA to include buffer zones, relevant to the use of DRTs, on labels or permits as described in chapter seven. When state legislation can support it, users may in the future be able to recalculate buffer zones according to their individual circumstances including such factors as their spray equipment, application rate, weather conditions etc (stage two). The spray drift policy will initially be applied to new substances and substances under chemical review. It will also be used for all new applications where spray drift assessment will be required. The policy may be extended to legacy products on a priority and risk basis and registrants may proactively elect to use the new policy. If you are preparing an application and require assistance to determine what

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information you may need to include with your application, it may be addressed through a [pre-application assistance application](#).

Reporting spray drift incidents

State and territory governments are responsible for addressing incidents of off-target spray drift. The following information will help you identify the process for reporting a spray drift incident in your state or territory:

- Australian Capital Territory—Contact the Environment Protection Authority by calling Canberra Connect on 13 22 81
- New South Wales—Refer to the [How to respond to pesticide misuse](#) web page and call the environment line on 131 555, or email info@environment.nsw.gov.au
- Northern Territory—Refer to the [NT WorkSafe Chemical Spray Drift](#) bulletin or call the pollution response line on 1800 064 567
- Queensland—Refer to the [Reporting chemical spray drift](#) web page
- South Australia—Refer to the [Chemical misuse \(including spray drift\)](#) web page and call the biosecurity SA agricultural and veterinary chemicals hotline on 1300 799 684 or email PIRSA.RuralChemicals@sa.gov.au
- Tasmania—Refer to the [Spray Information and Incidents](#) web page
- Victoria—Refer to the [Reporting spray drift of agricultural chemicals](#) web page
- Western Australia—Refer to various documents on the [Guides on pesticide use for industry and local government](#).

General chemical use information

Many industry representative groups and state and territory governments produce general guidance for applying agricultural chemical products safely. These can be used for reference, but are not necessarily reflective of mandatory legal requirements unless specifically stated.

Industry representative groups

- Grains Research and Development Corporation—Refer to the [Practical tips for spraying factsheet](#)
- National Working Party on Pesticide Applications (NWPPA)—Refer to the [NWPPA website](#).

State and territory governments

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- Australian Capital Territory—Refer to various documents on the [Pest and weed control](#) web page
- New South Wales—Refer to various documents on the [Pesticides](#) web page and watch the [safe use of pesticides video](#)
- Northern Territory—Refer to various documents on the [Chemical services](#) web page
- Queensland—Refer to the [Guidelines for safe use of agricultural and veterinary chemicals](#) web page
- South Australia—Refer to various documents on the [Biosecurity SA: rural chemicals](#) web page
- Tasmania—Refer to the relevant [code of practice](#)
- Victoria—Refer to the [A guide to using agricultural chemicals in Victoria](#) web page and watch the [chemical use videos](#)
- Western Australia—Refer to the document [A guide to the use of pesticides in Western Australia](#).

APVMA, 19 July 2019

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

Reminder: Provide your feedback on the Review recommendations by 5 August

2019-07-26

Safe Work Australia invites feedback on the recommendations of the review of the model WHS laws. The [model WHS laws](#) were reviewed in 2018. The [Review of the model WHS laws: Final report](#) was released in February 2019 and includes 34 recommendations. A [Consultation Regulation Impact Statement \(RIS\)](#) on these recommendations is open until 5 August. Submissions can be made [online](#). Safe Work Australia welcomes feedback and comments from all stakeholders who may be impacted by the recommendations. The agency is particularly interested in feedback on the review recommendations that may have the greatest impact on workers, business and the community, including:

- introducing regulations dealing with psychosocial health;
- new arrangements for health and safety representatives (HSR) and work groups in small businesses;
- clarifying workplace entry of HSR assistants and WHS entry permit holders;
- providing HSRs with choice of training course;

Safe Work Australia invites feedback on the recommendations of the review of the model WHS laws.

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Safe Work Australia has set up a [consultation page](#) with information and details on how you can participate.

Safe Work Australia, 22 July 2019

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

Australia GHS classifications updated

2019-07-26

On 19 July 2019, Safe Work Australia's Hazardous Chemical Information System (HCIS) was updated. 54 substances (already classified) had their classifications updated while 13 substances (previously not classified) were assigned new classifications.

Yorda's Hive, 24 July 2019

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

Views sought on reassessment of methyl bromide

2019-07-26

New Zealand's Environmental Protection Authority (EPA) is seeking submissions on an application for the reassessment of the hazardous substance methyl bromide. Methyl bromide is used as a fumigant in the quarantine and pre-shipment treatment of logs, produce, flowers and other goods. The EPA's chemical reassessment programme reviews hazardous substances already approved in New Zealand. Under New Zealand law, a chemical's approval does not expire. Reassessment is the only formal legal process we can use to review the approval of a chemical classed as a hazardous substance. In April 2018, the EPA decided that grounds existed for a reassessment of methyl bromide, following an application by Stakeholders in Methyl Bromide Reduction Inc (STIMBR). Grounds to reassess were granted based on data that showed New Zealand's use of the fumigant has increased from over 400 tonnes a year in 2010, to more than 600 tonnes in 2016. One of the criteria to meet grounds for reassessment under the Hazardous Substances and New Organisms Act is a significant change in the quantity of substance imported into, or manufactured in, New Zealand. Earlier this year, STIMBR applied for a reassessment of the approval for methyl bromide. The EPA is processing this application as a modified reassessment. This means that the reassessment will only consider specific aspects of the approval, such as the required controls. The approval to import or manufacture methyl bromide cannot be revoked in this type of reassessment. Users

New Zealand's Environmental Protection Authority (EPA) is seeking submissions on an application for the reassessment of the hazardous substance methyl bromide.

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of methyl bromide in New Zealand are required to recapture and safely dispose of the gas used in their fumigation activity from October 2020. The timeframe was set by the 2010 reassessment decision, to allow for the development, acquisition and installation of suitable equipment for recapture. Submissions on the reassessment application close at 5.00 pm on 29 August 2019. Further information is available at:

- [Visit the consultation page for more information, including submission guidelines and a timeline.](#)
- [See information on the chemical reassessment program.](#)

NZ EPA, 18 July 2019

<http://www.epa.govt.nz>

MoE Deny Environmental Regulations Hinder Localisation of Semiconductor Materials

2019-07-26

Recently, the trade friction between Japan and South Korea on semiconductor materials has caused worldwide concern. In the face of Japan's tough attitude, South Korea has to find other ways to obtain these important raw materials in a short time. One of the most contentious issues for South Koreans is the country's lack of self-sustainability in semiconductor raw materials. Korea Advanced Semiconductor Industry Structure Research Association reported in the Response Plan to Japan Semiconductor Materials Export Regulations that high-purity hydrogen fluoride (etching gas) is difficult to localise because of Korea's domestic environmental regulations. This viewpoint was echoed by many in the media and the Ministry of Environment (MoE) has been blamed for South Korea's current semiconductor woes. Facing the public's accusations and questions, MoE published [an explanation](#) on 8th July defending themselves. In the explanation, MoE pointed out that environmental regulations have played a pivotal role in reducing chemical safety accidents and that many special measures have been taken to offset the deleterious impact of environmental regulations and ensure raw material self-sustainability. MoE listed two sets of comparative data to prove the important role of Off-Site Consequence Analysis (OCA) in CCA: the workplaces for hazardous chemicals that have obtained a business license has increased from 8222 in December 2014 to 14,676 in December 2018, and chemical accidents have decreased from 113 in 2015 to 66 in 2018. OCA is an institutional measure, which is mentioned as the "environmental regulations", and was implemented to prevent

In South Korea, the localisation of semiconductor materials has been heatedly discussed, and MoE's environmental regulations are considered to be the main resistance to localisation.

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chemical accidents, strengthen safety standards, and predict the impact of accidents to minimise disasters. MoE emphasized that OCA is a necessary measure to guarantee safety when handling hazardous chemicals and is not implemented to restrict the construction of factories. MoE declared that many special measures have been taken to revitalise the raw materials sector, such as: offering exemptions from import declarations, permits for research or laboratory reagents, exemptions from business license requirements, support in experimentation and research and exemptions from OCA requirements under certain conditions. MoE pointed that the response plan also mentioned other factors affecting the localisation of semiconductor materials, such as manufacturers' own technical limitations and the high cost of self-production. What's more, the production of high-purity hydrogen fluoride totally relies on equipment imported from Japan. When MoE receives an application, it needs to issue a new license to the facility only after the potential for Hydrogen Fluoride leakage has been thoroughly addressed. At last, to accelerate the localisation of semiconductor materials, MoE stated that it will promptly handle applications for factory business licenses and provide compliance support for small and medium-sized enterprises and retail companies, at the same time guaranteeing national security and enterprise competitiveness. Further information is available at: [MoE Explanation](#)

Chemlinked, 17 July 2019

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

AMERICA

Communication and Recordkeeping Requirements Related to EPA Ban on Consumer Use Paint Removers Containing Methylene Chloride Go in Effect on 26 August 2019

2019-07-22

In the 27 March 2019, *Federal Register*, the U.S. Environmental Protection Agency (EPA) issued its final regulatory rulemaking that prohibits the manufacture (including import), processing, and distribution of methylene chloride for consumer paint and coating removal. Starting on 26 August 2019, which is 90 days after the effective date of the final rule, a company that manufactures, processes, or distributes in commerce methylene chloride is required to provide notification to downstream users of the

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consumer use paint remover restrictions via Safety Data Sheets (SDS). This notification requirement applies to all manufacturers, processors, or distributors of methylene chloride and is not limited only to those companies engaged with paint remover products. The EPA rulemaking provides the following specific text that must be included in the SDS:

- SDS Section 1.(c): "This chemical/product is not and cannot be distributed in commerce (as defined in TSCA section 3(5)) or processed (as defined in TSCA section 3(13)) for consumer paint or coating removal."
- SDS Section 15: "This chemical/product is not and cannot be distributed in commerce (as defined in TSCA section 3(5)) or processed (as defined in TSCA section 3(13)) for consumer paint or coating removal."

According to the final rule, this downstream notification is needed to ensure "...processors and distributors are aware of the restrictions for methylene chloride in paint and coating removal; enhances the likelihood that the risks associated with this use of methylene chloride are addressed throughout the supply chain; and also streamlines compliance and enhances enforcement, since compliance is improved when rules are clearly and simply communicated." (Reference 30 from EPA rulemaking: Giles, C. EPA. "Next Generation Compliance." Environmental Forum. October 2013, p 22-26. Washington, DC.)

In addition to the information to be included in the SDS, manufacturers, processors, and distributors must also retain shipping records starting on 26 August 2019. Information required to be maintained includes:

- Documentation of the entities to whom methylene chloride was shipped;
 - A copy of the downstream notification provided; and
 - The amount of methylene chloride shipped.
- EPA requires that these records be kept for three years from the date of shipment. EPA has indicated that the records can be kept at a company's headquarters or at the facility for which the records were generated.

Commentary

The downstream communication and recordkeeping provisions apply to any company that manufactures, processes, or distributes methylene chloride. Given EPA's regulatory attention has been laser-focused on methylene chloride use in paint remover products, it is possible

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that entities engaged with methylene chloride in non-paint remover applications may not be aware of these soon to be implemented requirements. We hope that EPA makes every effort to conduct outreach to methylene chloride manufacturers to ensure that compliance information is being properly transmitted to impacted parties. In addition, the rulemaking provides some additional clarification as to what constitutes a “retailer” for purposes of this rulemaking. Specifically, the rule states that “a retailer includes a person that distributes in commerce or makes available a chemical substance, mixture or article to consumers, including via internet sales or distribution. Any distributor with at least one consumer client is considered a retailer...” Again, we hope that EPA appreciates this strict definition of retailer may not be appropriately known to potentially impacted entities and will do its due diligence to outreach.

National Law Review, 22 July 2019

<http://www.natlawreview.com>

EPA Takes Important Step to Further Protect Children from Exposure to Lead-Contaminated Dust

2019-07-26

The United States Environmental Protection Agency (EPA) Administrator Andrew Wheeler, along with Housing and Urban Development Secretary Ben Carson, announced new, tighter standards for lead in dust on floors and window sills to protect children from the harmful effects of lead exposure. “EPA is delivering on our commitment in the Trump Administration’s Federal Lead Action Plan to take important steps to reduce childhood lead exposure,” said EPA Administrator Andrew Wheeler. “Today’s final rule is the first time in nearly two decades EPA is issuing a stronger, more protective standard for lead dust in homes and child care facilities across the country.

“EPA’s updating its standards for lead dust on floors and windowsills in pre-1978 homes and child-occupied facilities is an important advance,” said Secretary Carson. “We will use this new rule in updating the lead safety requirements for the pre-1978 housing we assist.” Since the 1970s, the United States has made tremendous progress in lowering children’s blood lead levels. In 2001, EPA set standards for lead in dust for floors and window sills in housing, however since that time, the best available science has evolved to indicate human health effects at lower blood lead levels than previously analysed. To protect children’s health and to continue making progress on this important issue, EPA is lowering

The United States Environmental Protection Agency (EPA) Administrator Andrew Wheeler, along with Housing and Urban Development Secretary Ben Carson, announced new, tighter standards for lead in dust on floors and window sills to protect children from the harmful effects of lead exposure.

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the dust-lead hazard standards from 40 micrograms of lead per square foot ($\mu\text{g}/\text{ft}^2$) to 10 $\mu\text{g}/\text{ft}^2$ on floors and from 250 $\mu\text{g}/\text{ft}^2$ to 100 $\mu\text{g}/\text{ft}^2$ on window sills. The more protective dust-lead hazard standards will apply to inspections, risk assessments, and abatement activities in pre-1978 housing and certain schools, child care facilities and hospitals across the country. Lead-contaminated dust from chipped or peeling lead-based paint is one of the most common causes of elevated blood lead levels in children. Infants and children are especially vulnerable to lead paint exposure because they their growing bodies absorb more lead than adults do, and their brains and nervous systems are more sensitive to the damaging effects of lead. They can be exposed from multiple sources and may experience irreversible and life-long health effects. Lead dust can be generated when lead-based paint deteriorates or is disturbed. The rule will become effective 180 days after publication in the Federal Register. Further information is available at: <https://www.epa.gov/lead/hazard-standards-lead-paint-dust-and-soil-tsca-section-403>

U.S EPA, 21 June 2019

<http://www.epa.gov>

Chemical Listed Effective June 28, 2019 as Known to the State Of California To Cause Cancer: P-Chloro- α,α,α -Trifluorotoluene (Para-Chlorobenzotrifluoride, PCBTF)

2019-07-26

Effective 28 June 2019, California's Office of Environmental Health Hazard Assessment (OEHHA) is adding *p*-chloro- α,α,α -trifluorotoluene (*para*-Chlorobenzotrifluoride, PCBTF) to the list of chemicals known to the State of California to cause cancer for purposes of Proposition 65. The listing of *p*-chloro- α,α,α -trifluorotoluene is based on formal identification by the National Toxicology Program (NTP), an authoritative body^[2], that the chemical causes cancer. The criteria used by OEHHA for the listing of chemicals under the "authoritative bodies" mechanism can be found in Title 27, Cal. Code of Regs., section 25306. The documentation supporting OEHHA's determination that the criteria for administrative listing have been satisfied for *p*-chloro- α,α,α -trifluorotoluene is included in the "Notice of Intent to List: *p*-Chloro- α,α,α -trifluorotoluene (*para*-Chlorobenzotrifluoride, PCBTF)" posted on OEHHA's website and published in the 23 November 2018 issue of the California Regulatory Notice Register (Register 2018, No. 47-Z). The publication of the notice initiated a public comment period that closed on 23 January 2019. OEHHA received one

Effective 28 June 2019, California's Office of Environmental Health Hazard Assessment (OEHHA) is adding *p*-chloro- α,α,α -trifluorotoluene (*para*-Chlorobenzotrifluoride, PCBTF) to the list of chemicals known to the State of California to cause cancer for purposes of Proposition 65.

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public comment. The comment and OEHHA's response is posted with the Notice of Intent to List.

A complete, updated Proposition 65 chemical list is available on the OEHHA website at.

In summary, p-chloro- α,α,α -trifluorotoluene is listed under Proposition 65 as known to the state to cause cancer, as follows:

| Chemical | CAS No. | Endpoint | Listing Mechanism* |
|---|---------|----------|--------------------|
| p-chloro- α,α,α -trifluorotoluene (para-Chlorobenzotrifluoride, PCBTF) | --- | Cancer | AB (NTP) |

Further information is available at: [Comment Submissions - Notice of Intent to List: p-Chloro- \$\alpha,\alpha,\alpha\$ -trifluorotoluene](#)

OEHHA, 28 June 2019

<http://www.oehha.ca.gov>

EPA Will Quit Sending TSCA CBI Claims of Deficiency in August 2019

2019-07-26

The United States Environmental Protection Agency (EPA) announced on 15 July 2019, that it will cease sending notices of deficiency to businesses that submit procedurally flawed confidential business information (CBI) claims under the Toxic Substances Control Act (TSCA). This is a significant change from the interpretation EPA announced in January 2017, and a company's failure to appreciate its consequences could prove damaging. Effective 15 August 2019, EPA will provide written notice to affected business submitters that because they submitted procedurally flawed CBI claims, including unsubstantiated CBI claims, those CBI claims are invalid, and the underlying information is not protected from disclosure under TSCA Section 14. EPA states in the *Federal Register notice* issued on 16 July 2019, that under its 2017 interpretation, it undertook a "non-statutorily required practice of sending a notice of deficiency to an affected business that submitted a non-exempt CBI claim without a substantiation, providing an opportunity to correct the deficiency." 84 Fed. Reg. 33939. Under the new policy, EPA will provide written notice to affected business submitters that because they submitted procedurally flawed CBI claims,

The United States Environmental Protection Agency (EPA) announced on 15 July 2019, that it will cease sending notices of deficiency to businesses that submit procedurally flawed confidential business information (CBI) claims under the Toxic Substances Control Act (TSCA).

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including unsubstantiated CBI claims, those CBI claims are invalid, and the underlying information is not protected from disclosure under TSCA Section 14. EPA notes that unlike the notice of deficiency, this written notice will not provide affected businesses 30 calendar days to remedy their deficient CBI claims. Instead, the written notice will inform affected businesses that their “procedurally flawed” CBI claims may be disclosed to the public without further notice.

National Law Review, 17 July 2019

<http://www.natlawreview.com>

New NIOSH Report Provides Process for Chemical Management

2019-07-26

A vast number of chemical substances do not have occupational exposure limits (OELs) for the workplace, potentially exposing workers to substances at levels that could be harmful. The National Institute for Occupational Safety and Health (NIOSH) recently released a chemical management strategy that can quickly and accurately assign chemicals into categories, or “bands,” in order to protect workers on the job. Occupational exposure banding is a voluntary process that assigns each chemical to a category based on its toxicity and any negative health outcomes associated with exposure to that chemical. The new Technical Report – The NIOSH Occupational Exposure Banding Process for Chemical Management – provides a process with easy procedures and clear rules for assignment and can be used in a broad spectrum of workplace settings. The occupational exposure banding process is not meant to replace quantitative occupational exposure limits (OELs); rather, it is a voluntary approach which provides a starting point to inform risk management decisions for controlling chemical substances that do not have OELs. “NIOSH has devoted significant efforts to develop, assess, and validate the occupational exposure banding strategy with the overall goal of reducing safety and health risks for workers,” said NIOSH Director John Howard, M.D. “In the absence of formalised OELs, the exposure banding approach serves to identify workplace hazards and helps employers implement control strategies that keep workers safe on the job.” The long-awaited resource can serve as the foundation for making exposure-control decisions. Public health agencies, practicing occupational health and safety professionals, employers, trade associations, labor organisations, and state-level programs can use this process to protect workers from occupational exposures to chemicals. The new Technical Report fully details the use

The National Institute for Occupational Safety and Health (NIOSH) recently released a chemical management strategy external icon that can quickly and accurately assign chemicals into categories, or “bands,” in order to protect workers on the job.

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and application of the NIOSH occupational exposure banding process and provides a summary of efforts taken to evaluate its effectiveness and usability. It includes an E-tool as a supplementary online application that provides users with an automated means to band chemical substances.

NIOSH, 10 July 2019

<http://www.cdc.gov/niosh>

EUROPE

ECHA Updates Chemicals Database, Increases Visibility of Nanomaterials

2019-07-26

On 3 July 2019, the European Chemicals Agency (ECHA) announced that several new features and improvements are now publicly available in its chemicals database, including new information in substance Infocards. ECHA has updated the substance Infocards with a new nanomaterial form section that shows whether the substance is placed on the European Economic Area (EEA) market in nanoform and provides links to the European Union (EU) Observatory for Nanomaterials (EUON). Information on over 300 nanomaterials on the EU market can be found and linked to hazard data. The search uses data from Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation registrations, the cosmetic ingredients notification portal, and the French and Belgian national inventories.

National Law Review, 20 July 2019

<http://www.natlawreview.com>

EFSA Publishes Scientific Opinion on Proposed Amendment to EU Specifications for Titanium Dioxide (E 171)

2019-07-26

On 12 July 2019, the European Food Safety Authority (EFSA) published in the *EFSA Journal* its "Scientific opinion on the proposed amendment of the EU specifications for titanium dioxide (E 171) with respect to the inclusion of additional parameters related to its particle size distribution." The opinion addresses the assessment of data provided by interested business operators in support of an amendment of the European Union

On 3 July 2019, the European Chemicals Agency (ECHA) announced that several new features and improvements are now publicly available in its chemicals database, including new information in substance Infocards.

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(EU) specifications for titanium dioxide (E 171) with respect to the inclusion of additional parameters related to its particle size distribution. According to the opinion, titanium dioxide (E 171), which is used as a food additive in food, undergoes no surface treatment and is not coated. The opinion states that interested business operators have proposed to revise the EU specifications for E 171 to include “a specification of more than 100 nm for median Feret min diameter and less than 50% of the number of constituent particles below 100 nm; measured by EM in both cases.” The EFSA Panel on Food Additives and Flavourings, after reviewing the data, “concluded that a specification of more than 100 nm for median minimal external dimension, equivalent to less than 50% of the number of constituent particles with a median minimal external dimension below 100 nm, should be inserted in the current EU specifications.” According to the opinion, the Panel determined that the conclusions made, and the uncertainties identified, in previous EFSA assessments of E 171 remain valid. The Panel reiterates the need for further research as recommended in previous opinions to decrease the level of uncertainty and acknowledges that interested business operators are carrying out additional studies with characterized E 171.

Nano & Other Emerging Technologies Blog, 17 July 2019

<http://nanotech.lawbc.com>

Austrian Academy of Sciences Publishes NanoTrust Dossier on Nano Registries

2019-07-26

The Institute of Technology Assessment of the Austrian Academy of Sciences has published a NanoTrust Dossier entitled “Nano-registries: Country-specific Solutions for Nano-regulation.” While the European Union (EU) has declined to create an EU-wide nano-registry, several EU Member States have adopted their own nano-registries. Belgium and France created stand-alone nano-registries, but Norway and Sweden added a “tick box” for nano to their product registries. Denmark established a stand-alone registry and added a “tick box” for nano to its product registry. According to the Dossier, Belgium, Denmark, France, Norway, and Sweden all use the European Commission’s (EC) Recommendation on the definition of nanomaterial (2011/696/EU). The NanoTrust Dossier provides an overview of the registries that includes a helpful summary of who must register and the registration threshold and the information required to be reported. The Dossier concludes that “it is necessary to close the information gaps on nanomaterials in the EU through a harmonised

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regulatory framework." The Dossier notes that Belgium, France, Sweden, and Denmark communicate closely "to maintain a certain consensus concerning the national registry projects of nanomaterials with a view to allow for future possible harmonisation." According to the Dossier, registrants do not know if they have to register a given substance, mixture, or product because they either lack information about the ingredients or knowledge about how to complete the registration process. The Dossier states that national registries pose a challenge for industry and free trade across borders within the EU, and small and medium enterprises are particularly affected by the financial burden of a time-consuming registration process. The Dossier suggests that a holistic framework, such as the one proposed in the 2017 article "[React now regarding nanomaterial regulation](#)," "can help gather data on nanomaterials within the European Union, promising increased transparency and benefits for workers, the environment and consumers."

Nano & Other Emerging Technologies Blog, 12 July 2019

<http://nanotech.lawbc.com>

Mitsotakis pledges to finally implement smoking ban in Greece

2019-07-26

The newly-elected centre-right government (New Democracy-EPP) in Greece has vowed to implement a smoking ban law in enclosed public places, which has existed since 2008 but never took effect. Greece is one of the few EU member states, where smoking in enclosed public places is banned but in practice, it's allowed. According to a World Health Organisation report, Greece's compliance with the framework of the smoke-free environment is quite poor. A law adopted in 2008 that prohibited smoking in public places has never been implemented. In addition, according to Eurostat, together with Bulgaria, Greece tops the list of smoking rates across the EU. Austria is one of the last EU members where the smoking ban has not been fully enforced and smoking is still allowed in bars and restaurants. A planned full ban was overturned by Sebastian Kurz's government but may be reinstated in November. Successive Greek governments have pledged to implement the 2008 anti-smoking law but never put it in practice. For this, Athens has been strongly criticised by the European Commission. "From our perspective, there is little value in having laws if they are not enforced," EU Health Commissioner Vytenis Andriukaitis told EURACTIV.com in 2017. The issue was also raised last year, when during a speech in Athens, Andriukaitis

Successive governments have pledged to implement a 2008 anti-smoking law but in practice, they never did so.

Regulatory Update

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showed a picture of Greece's then vice-minister for health, Pavlos Polakis from leftist Syriza party, smoking in a public space. "It's a shame," Anriukaitis said, adding that the Greek parliament should urgently address the issue. "It is not a matter of free will if someone smokes or not. When this happens in a public area, it is a violation of human rights," Andriukaitis added. Greek media reported that Prime Minister Kyriakos Mitsotakis is determined to put an end to this practice and finally implement the ban in hospitals, educational institutions, sports facilities, restaurants, cafes and clubs. The government is also planning to increase on-the-spot controls while in the next six months, citizens will be able to report violations of the law by telephone. Numerous activist movements have called on the Greek government to stop turning a blind eye to passive smoking and implement the law. Greek citizens believe that the non-implementation of the law is "cultural degradation", several surveys have suggested in the past.

Euractiv, 22 July 2019

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

REACH Update

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Public consultation on harmonised classification and labelling

2019-07-25

The European Chemicals Agency (ECHA) is seeking for comments on the harmonised classification and labelling proposals for 4 substances. These substances are as follows:

- Daminozide (EC 216-485-9, CAS 1596-84-5). For this consultation, the combined format including the draft (renewal) assessment report and the proposal for harmonised classification and labelling have been used; it runs parallel with the draft (renewal) assessment report according to Regulation (EC) No 1107/2009. Additional information on the active substance and the studies included in the CLH report are available on EFSA's consultation website.
- 2,2-dimethylpropan-1-ol, tribromo derivative; 3-bromo-2,2-bis(bromomethyl)propan-1-ol (EC 253-057-0, CAS 36483-57-5; 1522-92-5);
- Exo-1,7,7-trimethylbicyclo[2.2.1]hept-2-yl acrylate; isobornyl acrylate (EC 227-561-6, CAS 5888-33-5); and
- clofentezine (ISO); 3,6-bis(o-chlorophenyl)-1,2,4,5-tetrazine (EC 277-728-2; CAS 74115-24-5).

The deadline for comments is 24 September 2019. Further information is available at: [Give comments](#)

ECHA News, 24 July 2019

<http://echa.europa.eu>

New version of the Poison Centre submission portal released

2019-07-25

An updated version of the European Chemicals Agency's (ECHA) Submission portal has now been released. It includes a number of improvements to the tool for online dossier preparation and submission. For example, the new submit-online functionality allows you to create a dossier and proceed to the submission page directly without the need to export it first. Other improvements have been made e.g. to sections for

The European Chemicals Agency (ECHA) is seeking for comments on the harmonised classification and labelling proposals for 4 substances.

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reporting components and product information. Further information is available at: [ECHA submission portal](#)

ECHA News, 24 July 2019

<http://echa.europa.eu>

Updated Guidance on harmonised information relating to emergency health response published

2019-07-25

Version 2.0 of the *Guidance on harmonised information relating to emergency health response* – Annex VIII to CLP, is now available on the Guidance on CLP section of the European Chemicals Agency's website. This update provides further guidance and clarification on the obligations of duty holders related to distribution steps. Particularly it clarifies that 'duty holder' could potentially be every operator placing certain mixtures on the market. Further information is available at: [Guidance](#)

ECHA News, 24 July 2019

<http://echa.europa.eu>

New proposals to harmonise classification and labelling

2019-07-25

The European Chemicals Agency has published 3 new proposals to harmonise classification and labelling. Proposals have been submitted for:

- [4,4'-\[2,2,2-trifluoro-1-\(trifluoromethyl\)ethylidene\]diphenol; bisphenol AF](#) (EC 216-036-7, CAS 1478-61-1);
- [mepiquat chloride \(ISO\)](#); 1,1-dimethylpiperidinium chloride (EC 246-147-6, CAS 24307-26-4); and
- [1,3-dioxolane](#) (EC 211-463-5, CAS 646-06-0).

ECHA News, 24 July 2019

<http://echa.europa.eu>

Restriction dossier for calcium cyanamide submitted

2019-07-25

The European Chemicals Agency (ECHA) has submitted a proposal to restrict the use of [calcium cyanamide](#) (EC 205-861-8, CAS 156-62-7) as a fertiliser. The proposal will now be evaluated by ECHA's scientific Committees for Risk Assessment and Socio-economic Analysis, after which

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it will be subject to a public consultation. We will make the restriction report available on our website shortly. Further information is available at: [Registry of restriction intentions](#)

ECHA News, 24 July 2019

<http://echa.europa.eu>

Public consultation on potential candidates for substitution

2019-07-25

The European Chemicals Agency (ECHA) is seeking comments on potential candidates for substitution for Cyanamide (EC 206-992-3, CAS 420-04-2) in product-types 3 and 18. The evaluating competent authority identified Cyanamide in PT 3 and 18 as a potential candidate for substitution. Accordingly, ECHA launched a public consultation to gather relevant information on the availability of substitutes or alternatives to these active substance/product type combinations. Information on the availability of possible alternatives is highly important to support the comparative assessment that is required for the authorisation of biocidal products containing the active substance (considered as a candidate for substitution) and for assessing if one of the conditions for derogation under Article 5(2) is met to enable approval of this active substance. The deadline for comments is 25 August 2019.

ECHA News, 24 July 2019

<http://echa.europa.eu>

Submission of lead chromates restriction report postponed

2019-07-25

The submission of the Annex XV restriction report on lead chromate; lead sulfochromate yellow (C.I. Pigment Yellow 34) and lead chromate molybdate sulphate red (C.I. Pigment Red 104) by ECHA is postponed to 27 September 2019. Further information is available at: [Registry of restriction intentions](#)

ECHA News, 24 July 2019

<http://echa.europa.eu>

The European Chemicals Agency (ECHA) is seeking comments on potential candidates for substitution for Cyanamide (EC 206-992-3, CAS 420-04-2) in product-types 3 and 18.

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Testing proposals

2019-07-25

The European Chemicals Agency (ECHA) has launched nine new public consultations on testing proposals. The deadline for comments is 9 September 2019. There are currently 23 open public consultations on testing proposals. Further information is available at: [Give comments](#)

ECHA News, 24 July 2019

<http://echa.europa.eu>

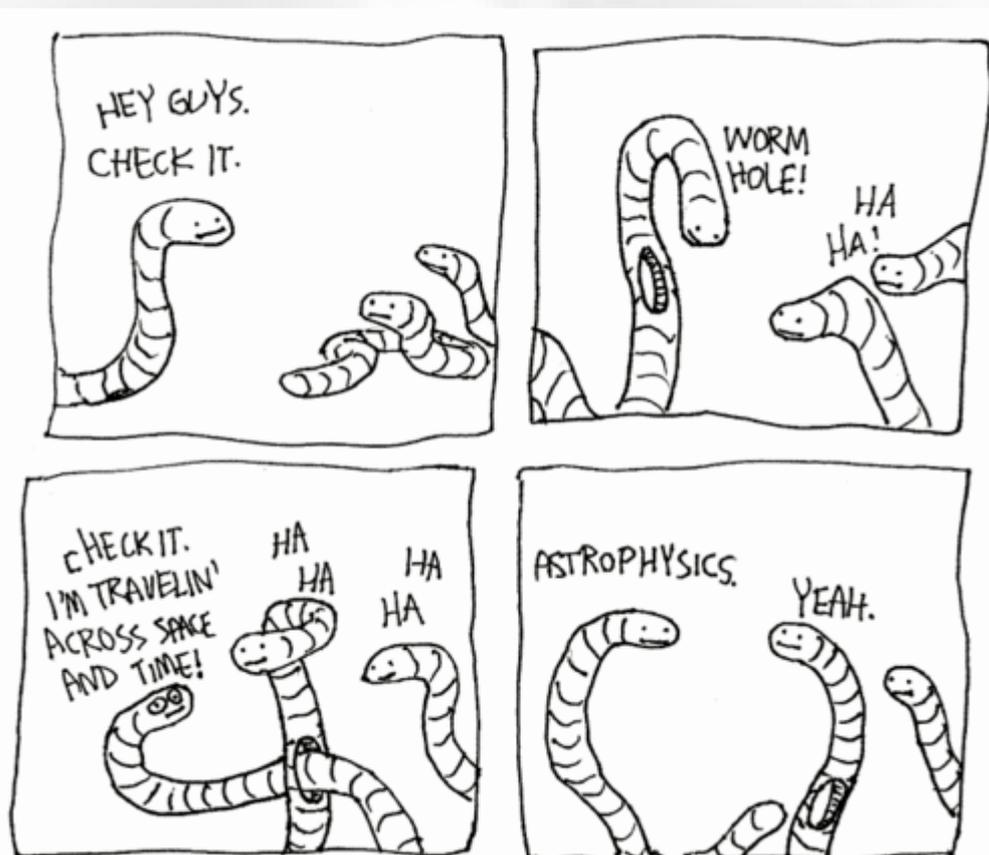
The European Chemicals Agency (ECHA) has launched nine new public consultations on testing proposals.

Janet's Corner

CHEMWATCH

Worm Hole

2019-07-26



science.memebase.com

Hazard Alert

CHEMWATCH

Dichlorvos

2019-07-12

Dichlorvos or 2,2-dichlorovinyl dimethyl phosphate is a organophosphate with the molecular formula $C_4H_7Cl_2O_4P$. [1]

Dichlorvos is an insecticide that is a dense colourless liquid. It has a sweetish smell and readily mixes with water. Dichlorvos used in pest control is diluted with other chemicals and used as a spray. It can also be incorporated into plastic that slowly releases the chemical. [2]

USES [2,3]

Dichlorvos is used for insect control in food storage areas, green houses, and barns, and control of insects on livestock. It is not generally used on outdoor crops. Dichlorvos is sometimes used for insect control in workplaces and in the home. [2] It is effective against mushroom flies, aphids, spider mites, caterpillars, thrips, and white flies in greenhouse, outdoor fruit, and vegetable crops. Dichlorvos is used to treat a variety of parasitic worm infections in dogs, livestock, and humans. Dichlorvos can be fed to livestock to control botfly larvae in the manure. It acts against insects as both a contact and a stomach poison. It is used as a fumigant and has been used to make pet collars and pest strips. It is available as an aerosol and soluble concentrate. Veterinarians use it to control parasites on pets. [3]

SOURCES & ROUTES OF EXPOSURE

Sources of Exposure [2]

- The general population is not likely to be exposed to dichlorvos.
- It has been found on some fruits, vegetables, and grain, but washing and processing destroys the dichlorvos.
- Breathing contaminated air or touching contaminated soil could expose people who live near a hazardous waste site containing dichlorvos.
- Workers who manufacture the chemical or use it are likely to be exposed.
- Breathing contaminated air or touching surfaces where dichlorvos was applied could expose people whose homes have been sprayed with dichlorvos.

Dichlorvos or 2,2-dichlorovinyl dimethyl phosphate is a organophosphate with the molecular formula $C_4H_7Cl_2O_4P$.

Hazard Alert

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Routes of Exposure [3,4]

The routes of exposure to dichlorvos are:

- Inhalation;
- Skin absorption;
- Ingestion; and
- Skin and/or eye contact

Dichlorvos is highly toxic by inhalation, dermal absorption, and ingestion. Because it is volatile, inhalation is the most common route of exposure. As with all organophosphates, dichlorvos is readily absorbed through the skin.

HEALTH EFFECTS [5]

Acute Effects

- Dichlorvos exerts its toxic effects in humans and animals by inhibiting the enzyme, acetylcholinesterase. Effects from acute exposure include perspiration, nausea, vomiting, diarrhoea, drowsiness, fatigue, headache, and at very high concentrations, convulsions, and coma.
- Tests involving acute exposure of rats, mice, and rabbits have demonstrated dichlorvos to have high to extreme acute toxicity from oral or dermal exposure and extreme acute toxicity from inhalation.

Chronic Effects

- Acetylcholinesterase inhibition may also occur in humans from chronic exposure to dichlorvos.
- Symptoms in animals orally exposed to dichlorvos include ataxia, salivation, dyspnea, tremors, and diarrhoea.
- The Reference Concentration (RfC) for dichlorvos is 0.0005 milligrams per cubic metre (mg/m³) based on decreased brain cholinesterase activity in rats.
- The Reference Dose (RfD) for dichlorvos is 0.0005 milligrams per kilogram body weight per day (mg/kg/d) based on plasma and red blood cell cholinesterase inhibition in male and female dogs and brain cholinesterase inhibition in male dogs.

Reproductive/Developmental Effects

- No information is available on the reproductive or developmental effects of dichlorvos in humans.

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- In one study, birth defects in foetuses were observed in rats exposed to dichlorvos by injection; however, in several other animal studies, birth defects were not observed.
- Sperm abnormalities were observed in mice injected with dichlorvos.

Cancer Risk

- No information is available on the carcinogenic effects of dichlorvos in humans.
- In a gavage study by the NTP, there was an increased incidence of tumours of the pancreas and leukaemia in male rats, tumours of the pancreas and mammary gland in female rats, and tumours of the forestomach in both sexes of mice.
- Dichlorvos was not found to be carcinogenic in an animal study by the National Cancer Institute (NCI) in which the compound was administered in the diet.
- EPA has classified dichlorvos as a Group B2, probable human carcinogen.

SAFETY [6]

First Aid Measures

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
- In case of skin contact: Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.
- In case of eye contact: Flush eyes with water as a precaution.
- If swallowed: Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Fire Information

- Suitable extinguishing media for fires containing dichlorvos: water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
- Special hazards arising from the substance or mixture with dichlorvos: carbon oxides, oxides of phosphorus, hydrogen chloride gas
- Firefighters should wear self-contained breathing apparatus for fire fighting if necessary.

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Exposure Controls & Personal Protection

Engineering Controls

- Avoid contact with skin, eyes and clothing.
- Wash hands before breaks and immediately after handling the product.

Personal Protective Equipment

The following personal protective equipment is recommended when handling dichlorvos:

- Eye/face protection: Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
- Skin protection: Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.
- Body Protection: Complete suit protecting against chemicals, the type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
- Respiratory Protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

REGULATION

United States [7]

OSHA: The Occupational Safety & health Administration has established the following Permissible Exposure Limit (PEL) for dichlorvos:

- General Industry: 29 CFR 1910.1000 Z-1 Table -- 1 mg/m³ TWA; Skin

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- Construction Industry: 29 CFR 1926.55 Appendix A -- 1 mg/m³ TWA; Skin
 - Maritime: 29 CFR 1915.1000 Table Z-Shipyards -- 1 mg/m³ TWA; Skin
- ACGIH: The American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for dichlorvos of 0.1 mg/m³ TWA (Inhalable Fraction) (Vapour and Aerosol); Skin; SEN; Appendix A4 - Not Classifiable as a Human Carcinogen; BEI

NIOSH: The National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for dichlorvos of 1 mg/m³ TWA; Skin

Australia [8]

Safe Work Australia: Safe Work Australia has set a Time Weighted Average (TWA) concentration for dichlorvos of 0.1 ppm or 0.9 mg/m³ for a 40-hour workweek.

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Gossip

CHEMWATCH

White Paper: These 12 Principles Are Shaping the Future of Autonomous Cars

2019-07-17

As nice as it'd be to have the option of catching up on some reading — or sleep — while an autonomous vehicle drives you to work, the real draw of self-driving cars is the idea that they'll be safer drivers than whoever just cut you off in the exit lane with inches to spare. After all, if the vast majority of traffic accidents are caused by human error, taking humans out of the equation should save lives, right? In theory, sure. But in practice? Only if we can build autonomous vehicles safer than, well, the average driver. And right now, the entire auto industry is approaching that same goal from countless directions, and no one even knows what the measure of success is — or should — be. To bring some orderliness to this currently chaotic situation, a group of 11 companies, including Intel, Audi, and Volkswagen, teamed up to publish a white paper titled "Safety First for Automated Driving," an exhaustive guide to developing safe autonomous vehicles. The 146-page-long document's centre-piece are twelve guiding principles detailing the various capabilities a self-driving car must have before it can be considered "safe." Here's a quick primer on each of them.

- **Safe Operation:** An autonomous vehicle must be able to cope with the loss of any of its critical components.
- **Safety Layer:** The self-driving car must know its own limits and understand when it's safe to return control to the human driver.
- **Operational Design Domain (ODD):** The autonomous vehicle must be prepared to assess the risks of typical driving situations.
- **Behaviour in Traffic:** The car's behaviour needs to be predictable to other drivers on the road, and it needs to act according to traffic rules.
- **User Responsibility:** The vehicle needs to be able to recognise a driver's state of alertness and communicate to them any tasks for which they are responsible.
- **Vehicle-Initiated Handover:** Autonomous vehicles must be able to let drivers know when they need to takeover and make it easy for them to do so. If a takeover request is ignored, the vehicle also needs to have a way to cope with the situation while minimising risk.
- **Driver-Initiated Handover:** The driver needs to have a way to explicitly ask to take over operation of the self-driving car.
- **Effects of Automation:** An autonomous vehicle must consider how automation could affect the driver even directly after the period of automated driving is over.

Eleven companies teamed up on this exhaustive guide to developing safe AVs.

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- **Safety Assessment:** There needs to be a consistent way to verify and validate the autonomous vehicle's ability to meet safety goals.
- **Data Recording:** If the self-driving car recognises an event or incident, it needs to be able to record relevant data in a way that doesn't violate applicable data privacy laws.
- **Security:** Safe autonomous vehicles will need to have some protection against security threats.
- **Passive Safety:** The self-driving car needs to be prepared for any crash scenarios that might be unique to vehicle automation.

This all sounds well and good. Accomplishing all — let alone most, or even a majority — of these goals is going to be another matter. Notably, a few major companies and tech players are missing from the list of people who assembled this list (i.e., Tesla, Waymo, et al). Hard not to wonder why: Maybe these companies, all of whom are seemingly behind in the race for self-driving vehicles, are looking to assemble some common ground to edge their behemoth competition out of (or maybe they simply have other ideas about safety). Whatever the case may be, the autonomous road race won't be won by anybody who doesn't adhere to these concepts if they become law — in other words, consider this just another in a long series of shots in the war to earn pole position.

Futurism, 3 July 2019

<https://futurism.com>

How common elements can make a more energy-secure future

2019-07-17

Thin-film solar panels, the cell phone in your hand and the LED bulb lighting your home are all made using some of the rarest, most expensive elements found on the planet. An international team including researchers at the University of Michigan has devised a way to make these kinds of optoelectronic materials from cheaper, more abundant elements. These compounds can also be "tuned" to efficiently harvest electrical energy from the different wavelengths of light in the solar spectrum and to produce the range of colours we like to use in lighting. Only specific kinds of compounds—a combination of two or more elements—can be used to make electronic devices that efficiently emit light or gather electricity. If you recall in your grade school chemistry classes, each column on the periodic table is considered a group of elements. For example, group III includes elements such as indium and gallium—both relatively scarce

An international team including researchers at the University of Michigan has devised a way to make these kinds of optoelectronic materials from cheaper, more abundant elements.

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elements that nevertheless currently underpin applications combining light and electricity. The problem is, these compounds often involve elements that are only found in a few locations around the world. "In fact, we're in danger of running out of some of those elements because they're not easy to recycle and they're in limited supply," said physicist Roy Clarke, who leads the U-M effort. "It's not viable for technology to rely on something that's likely to run out on a scale of 10 to 20 years." The research team found a way to combine two common elements from columns bracketing group III to make a novel compound composed of elements from groups II, IV and V. This II-IV-V compound can be used in place of the rare elements typically found in III-V optoelectronic materials with similar properties—except far more abundant and less expensive. The new compound of zinc, tin and nitrogen can harvest both solar energy and light, so it would work in thin-film solar panels as well as in LED light bulbs, cell phone screens and television displays. Using magnesium instead of zinc further extends the reach of the materials into blue and ultraviolet light. Both compounds are also "tunable"—that is, when the researchers grow crystals of either compound, the elements can be ordered in such a way that the material is sensitive to specific wavelengths of light. This tunability is desired because it allows researchers to tweak the material to respond to the widest range of wavelengths of light. This is especially important for light-emitting diodes so that device designers can select the colour of light produced. "When you're lighting a home or an office, you want to be able to adjust the warmth of the light, oftentimes mimicking natural sunlight," Clarke said. "These new II-IV-V compounds would allow us to do that." Graduate students Robert Makin, Krystal York and James Mathis grew the thin films in the lab of Steve Durbin, a professor of electrical and computer engineering at Western Michigan University. Makin, who just earned his Ph.D. from WMU and is the lead author of the study, used a technique called molecular beam epitaxy (MBE) to produce the desired compounds under the correct conditions to make films with a carefully controlled degree of atomic ordering. MBE lays down each atomic layer of the compound in a systematic fashion, so the researchers could study the thin layer, or film, structure as they were growing it. The next phase of the research, leading into construction of various device designs, calls for detailed studies of this material family's electronic response and testing of various nanoscale architectures which exploit their versatility. The research team also includes members from the Université de Lorraine

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in France and the University of Canterbury in New Zealand. Their research is published in Physical Review Letters.

Phys.org, 3 July 2019

<http://phys.org>

The “Woodstock of Physics” Is Finally Living Up to Its Promise

2019-07-17

In 1987, I was a postdoctoral researcher on the hunt for a permanent job in physics. So of course, I made a point to attend the American Physical Society (APS) March Meeting, where every year physicists who study solids (or condensed matter) gather to report on their experiments, compare notes and geek out on the latest breakthroughs. That year, the biggest breakthrough by far was high-temperature superconductivity. Ring a bell? It well might. After all, it made the cover of Time magazine that spring, earned its discoverers a Nobel Prize the following fall. Unlike astrophysics and particle physics, it is not so common for our specialty to make headlines. We condensed matter scientists basked in the spotlight. But it faded fast: The revolution didn't happen, and science reporters moved on to dark matter, the Higgs boson and colliding black holes. Well, it is time to pay attention again. Some of us science soldiers never stopped working on high-temperature superconductivity, and now we have something to show for it. But I'm getting ahead of myself. First, let me finish the story of the physics conference heard round the world.

THE WOODSTOCK OF PHYSICS

In the year prior to that 1987 APS meeting, Georg Bednorz and Alex Müller had published news of a novel kind of superconductor—a material that conducts electricity with perfect efficiency. Superconductors had been around for decades at that point. Unfortunately, they operated only at temperatures so low you needed pricey liquid helium to create the effect, severely limiting their applications. Bednorz and Müller, however, had discovered a superconductor that worked in much warmer (or rather, less frigid) environments. Then, in February of 1987, other researchers had discovered a related material with superconductivity that was attainable using cheap liquid nitrogen as a coolant. These thrilling findings inspired many physicists to join the hunt for the next great “high-temperature superconductor” (HTS). With HTS fever running rampant, the APS organised a special session on the topic at the March meeting. I arrived

A landmark meeting in 1987 promised that high-temperature superconductors would change the world. No one realised how long it would take

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an hour early, only to find some 2,000 scientists waiting in the corridors as if for the start of a Rolling Stones concert—except that everyone was sober. I was lucky enough to snag a seat near the rear of the conference hall, but hundreds of others had to watch on monitors outside. That session, now known as the “Woodstock of Physics,” lasted until the small hours of the morning, the temperature in the room climbing as one scientist after another shared their findings. Craning to read each slide, we practically levitated on the wave of optimism as presenters talked of the game-changing technologies that would soon result from these astonishing materials. “The world has changed,” more than one speaker said, which is not the sort of language usually employed at staid physics meetings. Yes, the materials were remarkable. But for decades after that heady gathering, the HTS technology revolution remained as elusive as the world peace that was supposed to result from the original Woodstock. Many condensed matter physicists abandoned the HTS field for newer hot topics, like graphene and topological materials. Over the decades, I have observed the ebb and flow of HTS research and done quite a bit myself, including at the National High Magnetic Field Laboratory (the MagLab), the site of a lot of that ebbing and flowing. I am now the lab’s director—a little older, a little wiser and a lot more clear-eyed about proclamations that The World Has Changed. So, it is as a seasoned sceptic that I say that the HTS technology era is finally here—for real. The proof: We have built and will soon make available to scientists a superconducting magnet, made in part with HTS materials, that is a third stronger than any other superconducting magnet in the world. And this month in *Nature*, our scientists shared news of a test magnet that, using the same material and some very clever engineering, reached a world-record magnetic field that is promising for a host of applications, including still stronger research magnets. Also, at the MagLab, we are in the midst of a multimillion-dollar, National Science Foundation–funded project to design those still-stronger magnets. It has been a slog, for sure. But in science, overnight revolutions happen about as often as researchers exclaim, “Eureka!” (Pro Tip: We hardly ever exclaim “Eureka!”). In their excitement about the scientific breakthroughs, HTS pioneers failed to foresee the many technical and economic hurdles ahead—like what it takes to turn a new superconductor into a wire. Most HTS materials—REBCO (rare earth barium copper oxide), for example, or BSCCO (bismuth strontium calcium copper oxide)—consist of several elements that must be painstakingly measured, mixed and baked into a high-quality form. None of them are malleable, like copper. Instead, they are brittle, because they are ceramics. Imagine transforming a beautiful piece of REBCO pottery into a tape of perfectly aligned crystals, then spooling that into a coil to make an electromagnet. It was

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a Rumpelstiltskin-scale challenge. But unlike Rumpelstiltskin, it took us a couple of decades just to figure that part out. Given such obstacles, the question should not be “What took you scientists and engineers so long to make HTS magnets?” but rather “How did you do that so fast!?”

SUPERCONDUCTORS ARE CHANGING THE WORLD

New materials pave the way (sometimes literally) for new eras. The discovery of bronze sparked profound changes in trade, government, agriculture, civilisation and warfare. An advance in asphalt production in the late 19th century led to the paving of many of the world’s roads. Steel made it possible for buildings to soar more than a quarter mile into the sky. Plastics? Imagine modern life without them. Or modern technology without silicon. The story line is the same in superconductivity, as new materials lead to ever more powerful magnets. (Magnetic fields are measured in teslas, with a fridge magnet having a field of about 0.01 tesla). In the early 1960s, the discovery of niobium-titanium boosted superconducting magnets to 10 teslas, enabling their use in everything from MRI machines to particle accelerators. In the mid-1970s, scientists discovered that niobium mixed with tin was an even better superconductor, leading to magnets of 24 teslas, now used for research at hundreds of universities. With HTS, we are in the midst of writing the next chapter in this story. We know that REBCO, which can carry extremely high amounts of electricity, could theoretically generate 100 teslas. One day, it could be the stuff that makes the magnet equivalent of the Empire State Building. I may have gotten a bit tipsy with overoptimism in that warm conference hall decades back. But these days, I base more sober predictions on experimental evidence, experience and peer-reviewed publications. Such as: HTS technology, in magnets and beyond, will bring about life-changing improvements in materials, medicine and energy. Here’s how. New materials bring new technologies: your smartphone contains more than a dozen materials that were not yet invented at the time of the Woodstock meeting. Today, a single layer of carbon atoms arranged in a honeycomb pattern, called graphene, is showing promise for building ultrafast electronics. Two stacked layers of graphene might one day form the heart of a quantum computer. Other atomically thin materials are expected to soon outperform today’s silicon solar cells. And powerful magnets are one tool that scientists use to build an understanding of these new materials. HTS magnets will power high-definition MRIs that will make today’s scans look like aged daguerreotypes, bringing into focus individual nerve fibres and cells. Unlike today’s MRIs, which locate only the hydrogen in your body to map of your innards,

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future HTS-based machines will allow doctors to image any of the elements in your body. They will image sodium to learn if chemotherapy is successfully killing tumour cells, and oxygen to track glucose metabolism in tumours, offering a safer alternative to PET scans. These machines will reveal the intricate structures of the cell walls of viruses so that scientists can design and deploy molecular missiles to infiltrate them. These next-generation instruments will map more elements outside the body, as well. They will track lithium in batteries, hydrogen in fuel cells and photosynthesis in plants, giving scientists clues on how to build better solar cells and energy storage devices. So, when exactly will all this occur? I'm not gonna fall for that one again.

Scientific American, 12 July 2019

<http://www.sciam.com>

This Eerie Material Could Be Key to 'Terraforming' Pockets of Mars

2019-07-17

While our warming atmosphere on Earth threatens many living things, spurring on global warming on Mars could be the key to making the planet habitable for Earthly life. And scientists think they may have identified a material that can help turn up the thermostat for parts of the Red Planet. "Mars is the most habitable planet in our Solar System besides Earth," said planetary geologist Laura Kerber from NASA's Jet Propulsion Laboratory. "But it remains a hostile world for many kinds of life." The main things required to make Mars life-friendly are more heat and protection from ultraviolet (UV) rays. And additional atmospheric heat of about 50 degrees Kelvin (50 Celsius; 90 Fahrenheit) is needed to warm the dry planet's surface enough to allow water to remain in its drinkable form. Previous proposals to give Mars a fever included releasing greenhouse gases such as CO₂ from the ground - basically emulating what we've inadvertently achieved here on Earth. But a study last year identified several problems to this approach. "Our results suggest that there is not enough CO₂ remaining on Mars to provide significant greenhouse warming were the gas to be put into the atmosphere; in addition, most of the CO₂ gas is not accessible and could not be readily mobilised," explained cosmochemist and planetary geologist Bruce Jakosky of the University of Colorado in a NASA press statement. "As a result, terraforming Mars is not possible using present-day technology," Now, however, a Martian phenomenon called a solid-state greenhouse effect has inspired another team to investigate a different approach - one that focuses on

A Martian phenomenon called a solid-state greenhouse effect has inspired another team to investigate a different approach - one that focuses on altering local pockets of Mars, rather than its entire atmosphere.

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altering local pockets of Mars, rather than its entire atmosphere. This type of localised insulation has already been detected at the Martian poles where its ice - composed of water mixed with heat-trapping CO₂ - snugly contains the heat that flowed through as light, warming the area below. Now, researchers have identified that silica aerogel, a material already used as insulation in Mars Exploration Rovers, has the properties required to create such a solid-state greenhouse effect. It would be like a cosy transparent blanket, allowing light through (which could be used for photosynthesis by the organisms beneath), but traps heat. In fact, aerogel has one of the lowest known abilities to transfer heat; the whole thing is over 97 percent air by volume, nestled in nanoscale silica 'fibres' that also reflect UV rays. "Silica aerogel is a promising material because its effect is passive," explained Kerber. "It wouldn't require large amounts of energy or maintenance of moving parts to keep an area warm over long periods of time." The researchers showed that to increase the local temperature by the required 50 degrees Celsius, they would need a 2-3 cm layer of silica aerogel. They were then able to demonstrate, by replicating the surface conditions of Mars in a lab, that this would allow water to remain liquid throughout the Martian year while also protecting anything below it from harsh UV radiation. Rather than terraforming the whole surface of the planet, this could create pockets suitable for life as we know it. "A system for creating small islands of habitability would allow us to transform Mars in a controlled and scalable way," Kerber summarised. Of course, this idea is still far from being a reality, with many pieces of the puzzle still to be resolved. For example, would it even be possible to manufacture this material on Mars? Inevitably, some scientists also believe we should be focusing more on the problems in our own atmosphere rather than trying to alter that of another planet. But Kerber and colleagues also point out an added bonus to transforming Mars via pockets of habitat: If life already does exist on Mars, this approach to becoming its neighbour would be less likely to cause it harm than full-scale terraforming. To put their ideas to the test, the team is now keen to try silica aerogel out in some of Earth's more challenging environments. This study was published in Nature Astronomy.

Science Alert, 15 July 2019

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

Scientists have figured out a way to produce graphene much more cheaply: with the help of bacteria.

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Researchers Just Showed Bacteria Can Produce Wonder-Material Graphene

2019-07-17

We already know what a wondrous material graphene can be – filtering water, dyeing hair, super-strengthening substances – but now scientists have figured out a way to produce it much more cheaply: with the help of bacteria. When mixed with oxidised graphite, which is relatively easy to produce, the bacterium *Shewanella oneidensis* removes most of the oxygen groups and leaves conductive graphene behind as a result. It's cheaper, faster, and more environmentally friendly than existing techniques to make the material. Using this process, we might be able to create graphene at the sort of scale necessary for the next generation of computing and medical devices – utilising graphene's powerful mix of strength, flexibility, and conductivity. "For real applications you need large amounts," says biologist Anne Meyer from the University of Rochester in New York. "Producing these bulk amounts is challenging and typically results in graphene that is thicker and less pure. This is where our work came in." Using the new method, Meyer and her colleagues were able to make graphene that's thinner, more stable, and longer-lasting than graphene that's produced by chemical manufacturing. This opens up all kinds of possibilities for the cheaper, bacteria-produced graphene. It could be used in field-effect transistor (FET) biosensors, devices that detect particular biological molecules, such as glucose monitoring for diabetics. Because the bacteria production process usually leaves behind certain oxygen groups, the resulting graphene is well-suited to being able to bind to specific molecules – exactly what an FET biosensor needs to do. This kind of graphene material could also be used as a conductive ink in circuit boards, in computer keyboards, or even in small wires to defrost car windshields. If needed, the bacteria process can be tweaked to produce graphene that's only conductive on one side. Graphene was first produced by using sticky tape to extract it from graphite blocks. Nowadays it's made via a number of different chemical methods that are applied to graphite or graphene oxide, but this newly discovered technique could be the most promising one yet – and without any of the harsh chemicals. As this is the first study to investigate the bacteria approach, plenty more research will need to be done before it can be scaled up and used to build the next generation of laptops. Nonetheless, the future of this incredible material continues to look bright. "Our bacterially produced graphene material will

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lead to far better suitability for product development," says Meyer. The research has been published in ChemistryOpen.

Science Alert, 14 July 2019

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

Improving heat recycling with the thermodiffusion effect

2019-07-17

Absorption heat transformers can effectively reuse the waste heat generated in various industries. In these devices, specialised liquids form thin films as they flow downward due to gravity. These liquid films can absorb vapour, and the heat is then extracted by a coolant so that it can be used in future processes. So far, however, there has been little research into how the performance of these films is influenced by the thermodiffusion effect—a behaviour seen in mixtures, where different types of mixture respond differently to the same temperature gradient. In a study recently published in EPJ E, researchers from the Fluid Mechanics group at Mondragon University and Tecnalia in Spain, led by M. M. Bou-Ali at Mondragon University, pooled their expertise in transport phenomena and absorption technology. Together, they explored for the first time the influence of the thermodiffusion property on the absorption, temperature and concentration profiles of falling films. With the industrial sector currently producing vast amounts of waste heat, the study is part of a growing effort to increase its efficiency by recycling unused heat. The researchers discovered that when the mass transfer of different mixture components varies due to the thermodiffusion effect, as is seen in a liquid with a negative thermodiffusion coefficient (water-lithium bromide), the absorption of surrounding vapours can be increased. They also found that the absorption in the films changes significantly as they flow down, due to widely varying temperatures and concentrations. The team arrived at their conclusions by incorporating a variety of thermodiffusion effect equations into numerical models, and subsequently calculating the resulting degrees of vapour absorption in the films. Since a third of our total energy consumption is currently in industrial processes, heat exchange devices are becoming more and more important to increasing their efficiency by recycling large amounts of heat. The work, therefore, offers valuable

Researchers at QUT, UGent and KIT have pioneered a novel TAD/naphthalene-based light-stabilised dynamic material that is stable under visible green light and becomes fluid over time in darkness.

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new insights into how the performance of falling film absorbers could be improved in the future.

Phys.org, 15 July 2019

<http://phys.org>

Green light for a new generation of dynamic materials

2019-07-17

Developing synthetic materials that are as dynamic as those found in nature, with reversibly changing properties and which could be used in manufacturing, recycling and other applications, is a strong focus for scientists. In a world-first, researchers from Queensland University of Technology (QUT), Ghent University (UGent) and Karlsruhe Institute of Technology (KIT) have pioneered a novel, dynamic, reprogrammable material—by using green LED light and, remarkably, darkness as the switches to change the material's polymer structure, and using only two inexpensive chemical compounds. One of these compounds, naphthalene, is well known as an ingredient in moth repellents. The new dynamic material could potentially be used as a 3-D printing ink to print temporary, easy-to-remove support scaffolds. This would overcome one of the current limitations of the 3-D process to print free-hanging structures. The research is part of an ongoing international collaboration between QUT macromolecular chemist and Australian Research Council Laureate Fellow Professor Christopher Barner-Kowollik, Dr. Hannes Houck, who recently completed his Ph.D. across QUT, UGent and KIT, UGent Professor Filip Du Prez, and KIT's Dr. Eva Blasco. Their findings have been published in the paper 'Light-Stabilized Dynamic Materials' in the Journal of the American Chemical Society (JACS).

Key points

- The new material was formed with naphthalenes and the coupling molecules triazolinediones (TADs);
- As long as green LED light shone on the material it remained stable and strong;
- Once the light was off and the material was kept in darkness, the chemical bonds of the network structure broke up and the material became soft and liquefied;
- The hard-to-soft process could be repeated with the flick of the switch, and the light could be dimmed to modulate the mechanical properties of the material;

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- Follow on research is looking at other chemical combinations that can achieve the same result

Professor Barner-Kowollik, from QUT's Science and Engineering Faculty, said what makes the discovery unique is that light is used as the trigger to stabilise, rather than destroy, chemical bonds—so the researchers have coined a new term, light-stabilised dynamic materials (LSDMs). "We are hoping to introduce LSDMs as a whole new class of materials," said Dr. Houck. "We debated whether to patent the new material, but decided not to wait and to publish the findings to advance knowledge and understanding of the processes involved." The researchers said what they have achieved is the opposite of what is usually done in chemistry and "many people didn't think it could be done". "Typically, you use different wavelengths of light or additional heat or harsh chemicals to break up the polymer molecule chains that form a network structure," they said. "However, in this case, we used green LED light to stabilise the network. The trigger to break up the network, make it collapse and flow away is actually the mildest one of all: darkness. Switch the light back on and the material re-hardens and retains its strength and stability." "This is what you call an out-of-equilibrium chemical system. The constant energy of the green light keeps the chemical system in this bonded form, pushing it out of its equilibrium. Take away the light, and the system goes back to its relaxed, lowest energy state." Professor Barner-Kowollik said the researchers had already been contacted by 3-D printing technology companies interested in application of the research. 3-D printing is used in the aerospace and automotive industries to make intricate parts and detailed prototypes. However, 3-D printing complex designs with overhangs or bridges is difficult or off limits because the 3-D process involves printing layer upon layer, and there is no direct support for layers in sharply angled structures. "What you need to 3-D print something like a bridge is a support scaffold, a second ink that provides that scaffold during printing of the design, but which you can later remove when it is no longer needed," he said. "With a light-stabilised dynamic ink used as a scaffold you could 3-D print under light, then switch the light off to let the scaffold ink flow away." Professor Du Prez and Professor Barner-Kowollik said another potential application for LSDMs was as a cell biology study tool, with biologists using it as a cell surface support they could alter by light modulation without damaging the cells.

Phys.org, 15 July 2019

<http://phys.org>

Algae could become an important resource in the future, if you understand the chemistry behind it. With the participation of TU Wien, researchers have now decoded how algae biomass is degraded.

Algae as a resource: Chemical tricks from the sea

2019-07-17

Algae form the basis of the marine ecosystem, and store more carbon than all land plants put together. The algae's carbohydrates are broken down by bacteria, which thereby turn them into an important energy source for the entire marine food chain. What exactly happens chemically during this degradation of algae biomass was, however, previously unknown. Now, an international research team has succeeded in analysing and understanding the entire route of degradation of an important polysaccharide. A large number of enzymes is required for this process and now, for the first time, it has been possible to clarify their biochemical function. With this knowledge, it will become possible to use algae as a resource: they can be used for fermentations, to produce valuable types of sugar or, in the future, even be processed towards bioplastics. The overall aim is to achieve an environmentally friendly circular economy in which renewable raw materials are used in as diverse a manner as possible. The research project was led by the University of Greifswald, in collaboration with TU Wien, the Max Planck Institute for Marine Microbiology (Bremen), the University of Bremen, research centre MARUM - Centre for Marine Environmental Sciences (Bremen) and Roscoff Marine Station (France). The results of the research were recently published in the specialist journal *Nature Chemical Biology*.

Breaking down macromolecules into their building blocks

For most people, algae usually seem rather unattractive - for instance, when they proliferate to form a colossal algal bloom near the coast, and in particular close to beaches. However, in future, carpets of algae may be used as a valuable source of material for industry. "In order to use algae, you need to break down the large molecules that they produce into usable individual components," explains Christian Stanetty from the Institute of Applied Synthetic Chemistry at TU Wien. "This is a highly complicated process but, fortunately, we have nature as an example: that's to say, certain bacteria can do this brilliantly." The international research team deciphered the way the marine bacteria *Formosa agariphila* degrades the polysaccharide ulvan, which is produced by the algae *Ulva* in up to 30% of its dry weight. This degradation process is a little chemical magic trick: in a series of steps, twelve different enzymes are employed to break down the macromolecule into ever smaller building blocks. "Our task at TU Wien was to clarify, with the help of nuclear magnetic resonance spectroscopy (NMR) and mass spectrometry, what these building blocks look like, exactly," says Christian Stanetty. "There were a few surprises along the way

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with several of the degradation products looking different to what we had expected. This demonstrated that the bacteria take different chemical pathways during the degradation of the sugar than we had expected." In this way, the researchers were able to find out which enzymes the bacteria use in the respective steps. "As a result, we now not only understand how these microorganisms gain access to this source of nutrition. We now also have access to a toolbox consisting of a whole spectrum of new biocatalysts, thus opening up the possibility of using this complex marine polysaccharide in a targeted manner as a resource for fermentations," says Prof. Uwe Bornscheuer from the University of Greifswald. The utilisation of algae to synthesise hydrocarbons is 100% carbon-neutral. If this method can be successfully used to create products that had previously been produced using fossil-based resources, it would be an important step for climate protection. "This is absolutely feasible," believes Prof. Marko Mihovilovic from TU Wien. "Initially, simple products, such as special types of sugars, can be targeted. But with an increasing understanding of the chemistry involved, the more success we will have in using these algae as precursors for complex syntheses, all the way to bioplastics."

The aim: a circular economy of biogenic resources

Interdisciplinary cooperation was crucial to the success of the project: "From a scientific point of view, it is only possible to answer research questions of this complexity by collaboration," underlines Marko Mihovilovic. "We have been working with our partners from Germany for some time now, with great success. We will also continue to do so in the future - this should allow us to make significant progress, and ultimately to progress towards sustainable chemistry that will enable a genuine, environmentally sound circular economy."

EurekAlert, 15 July 2019

<http://www.eurekalert.org>

High-performance sodium ion batteries using copper sulphide

2019-07-17

Researchers presented a new strategy for extending sodium ion batteries' cyclability using copper sulfide as the electrode material. This strategy has led to high-performance conversion reactions and is expected to advance the commercialisation of sodium ion batteries as they emerge as an alternative to lithium ion batteries. Professor Jong Min Yuk's team

Researchers presented a new strategy for extending sodium ion batteries' cyclability using copper sulfide as the electrode material

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confirmed the stable sodium storage mechanism using copper sulfide, a superior electrode material that is pulverization-tolerant and induces capacity recovery. Their findings suggest that when employing copper sulfide, sodium ion batteries will have a lifetime of more than five years with one charge per a day. Even better, copper sulfide, composed of abundant natural materials such as copper and sulfur, has better cost competitiveness than lithium ion batteries, which use lithium and cobalt. Intercalation-type materials such as graphite, which serve as commercialised anode materials in lithium ion batteries, have not been viable for high-capacity sodium storage due to their insufficient interlayer spacing. Thus, conversion and alloying reactions type materials have been explored to meet higher capacity in the anode part. However, those materials generally bring up large volume expansions and abrupt crystallographic changes, which lead to severe capacity degradation. The team confirmed that semi-coherent phase interfaces and grain boundaries in conversion reactions played key roles in enabling pulverisation-tolerant conversion reactions and capacity recovery, respectively. Most of conversion and alloying reactions type battery materials usually experience severe capacity degradations due to having completely different crystal structures and large volume expansion before and after the reactions. However, copper sulfides underwent a gradual crystallographic change to make the semi-coherent interfaces, which eventually prevented the pulverisation of particles. Based on this unique mechanism, the team confirmed that copper sulfide exhibits a high capacity and high cycling stability regardless of its size and morphology. Professor Yuk said, "Sodium ion batteries employing copper sulfide can advance sodium ion batteries, which could contribute to the development of low-cost energy storage systems and address the micro-dust issue"

EurekAlert, 15 July 2019

<http://www.eurekalert.org>

On the way to printable organic light emitting diodes

2019-07-17

Organic light-emitting diodes are components that no longer consist of compounds containing the semiconducting material gallium, but of so-called organic compounds in which carbon is a main component. Compared to conventional light-emitting diodes, however, the luminosity and lifetime of OLEDs are currently lower, which is why they represent a current field of research. Scientists at the MPI-P led by group leader Dr. Gert-Jan Wetzelaer (Department of Prof. Paul Blom) have now developed

Researchers are developing an efficient OLED consisting of only one layer

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a new OLED concept. Nowadays, OLEDs consist of various wafer-thin layers. Some layers are used to transport charges, while others are used to efficiently introduce electrons into the active layer in which light is generated. Thus, current OLEDs can easily consist of five to seven layers. The researchers have now developed an OLED which consists only of one single layer that is supplied with electricity via two electrodes. This simplifies the production of such OLEDs and paves the way for printable displays. With their first prototype, the Mainz scientists were able to show that they can generate a brightness of the emitted light of 10,000 candela/square meter with a voltage of only 2.9 volts -- this corresponds to about 100 times the luminosity of modern screens. Achieving such high luminosity at this low voltage is a record for current OLEDs. The researchers were also able to measure an external efficiency of 19%, which means that 19% of the electrical energy supplied is converted into light that comes out in direction of the viewer. Also with this value, the OLED prototype can compete with current OLEDs consisting of five or even more layers. In continuous operation, the researchers were able to measure a so-called LT50 lifetime of almost 2000 hours at a brightness equivalent to ten times that of modern displays. Within this time, the initial luminosity has dropped to 50% of its value. "For the future, we hope to be able to improve the concept even further and thus achieve even longer lifetimes. This means that the concept could be used for industrial purposes," says Wetzelaer. The scientists hope that their newly developed single-layer concept -- i.e. the reduced complexity of OLEDs -- will contribute to the identification and improvement of the processes responsible for the reduction in lifetime. The scientists are using a light-emitting layer based on so-called "Thermally Activated Delayed Fluorescence" (TADF). This physical principle has been known for several decades, but became the focus of OLED research about 10 years ago, when an efficient conversion of electrical energy into light was demonstrated in Japan. Since then, researchers have been working to produce TADF-based OLEDs, as these do not require expensive molecular complexes containing rare-earth metals that are being used in current OLEDs.

Science Daily, 10 July 2019

<http://www.sciencedaily.com>

A new class of 2D perovskite materials with edges that are conductive like metals and cores that are insulating was found by researchers who said these unique properties have applications in solar cells and nanoelectronics.

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2D perovskite materials found to have unique, conductive edge states

2019-07-17

A new class of 2D perovskite materials with edges that are conductive like metals and cores that are insulating was found by researchers who said these unique properties have applications in solar cells and nanoelectronics. "This observation of the metal-like conductive states at the layer edges of these 2D perovskite materials provides a new way to improve the performance of next-generation optoelectronics and develop innovative nanoelectronics," said Kai Wang, assistant research professor in materials science and engineering at Penn State and lead author on the study. Wang and a team of Penn State researchers made the discovery while synthesizing lead halide perovskite materials for use in next generation solar cells. Perovskites, materials with a crystal structure good at absorbing visible light, are an area of focus in developing both rigid and flexible solar cells that can compete commercially with traditional cells made with silicon. These 2D perovskite materials are cheaper to create than silicon and have the potential to be equally efficient at absorbing sunlight. The findings, reported in *Science Advances*, provide new insights into the charge and energy flow in perovskite materials, important for the continued advancement of the technology, the scientists said. "I think the beauty of this work is that we found a material that has completely different properties along the edges compared to the core," said Shashank Priya, professor of materials science and engineering and associate vice president for research at Penn State. "It's very unusual that the current can flow around the edges and not in the centre of a material, and this has huge implications for the design of solar cell architectures." The 2D perovskite materials consist of thin, alternately stacked organic and inorganic layers. The organic layers protect the inorganic layers of lead halide crystals from moisture that can degrade 3D versions of the material. This layered structure results in a large variation in conductivity along perpendicular and parallel directions. Using scanning and mapping techniques, the researchers found that sharp edges of the 2D single crystals exhibited extraordinarily large free charge carrier density. "This work reveals the distinct differences in optoelectronic properties between the crystal layer edge and the core region, which can give a hint toward answering other important questions raised in the field of optoelectronics about these 2D perovskite materials," Wang said. Researchers said the findings could boost performance of solar cells and LED technology by providing additional charge pathways within the devices. The findings also open the door for the development of innovative one-dimensional

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electrical conduction in nanoelectronics. "Across the length of these materials, you have a junction between metal and semiconductor, and there are a lot of hypothetical devices proposed based on that junction," Priya said. Because of the strong current found at the edges, 2D perovskite crystals may also be a good candidate for a triboelectric nanogenerator, the researchers said. Nanogenerators convert motion into electric power, which could lead to wearable technology that charges phones and other devices using both light and mechanical energy and inputs. Also contributing from Penn State were Congcong Wu, associate research professor, and Dong Yang and Ke Wang, assistant research professors. The Air Force Office of Scientific Research, the Office of Naval Research and the Army Small Business Innovation Research program provided funding for this research.

Science Daily 15 July 2019

<http://www.sciencedaily.com>

Novel nanoparticles deliver CRISPR gene editing tools into the cell with much higher efficiency

2019-07-17

A research collaboration between Tufts University and the Chinese Academy of Sciences has led to the development of a significantly improved delivery mechanism for the CRISPR/Cas9 gene editing method in the liver, according to a study published recently in the journal *Advanced Materials*. The delivery uses biodegradable synthetic lipid nanoparticles that carry the molecular editing tools into the cell to precisely alter the cells' genetic code with as much as 90 percent efficiency. The nanoparticles represent one of the most efficient CRISPR/Cas9 delivery tools reported so far, according to the researchers, and could help overcome technical hurdles to enable gene editing in a broad range of clinical therapeutic applications. The CRISPR/Cas9 gene editing system has become a powerful research tool uncovering the function of hundreds of genes and is currently being explored as a therapeutic tool for the treatment of various diseases. However, some technical hurdles remain before it can be practical for clinical applications. CRISPR/Cas9 is a large molecular complex, containing both a nuclease (Cas9) that can cut through both strands of a targeted genomic sequence, and an engineered 'single-guide' RNA (sgRNA) that scans the genome to help the nuclease find that specific sequence to be edited. Since it is a large molecular complex, it is difficult to deliver CRISPR/Cas9 directly into the nucleus of the cell, where it can do its work. Others have packed the editing

Researchers used lipid nanoparticles to deliver CRISPR/Cas9 gene editing tools for potential treatment of hyperlipidaemia.

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molecules into viruses, polymers, and different types of nanoparticles to get them into the nucleus, but the low efficiency of transfer has limited their use and potency for clinical applications. The lipid nanoparticles described in the study encapsulate messenger RNA (mRNA) encoding Cas9. Once the contents of the nanoparticles -- including the sgRNA -- are released into the cell. The cell's protein-making machinery takes over and creates Cas9 from the mRNA template, completing the gene editing kit. A unique feature of the nanoparticles is made of synthetic lipids comprising disulfide bonds in the fatty chain. When the particles enter the cell, the environment within the cell breaks open the disulfide bond to disassemble the nanoparticles and the contents are quickly and efficiently released into the cell. "We are just starting to see human clinical trials for CRISPR therapies," said Qiaobing Xu, co-corresponding author of the study and associate professor of biomedical engineering at Tufts University. "There are many diseases that have long been intractable for which CRISPR therapies could offer new hope -- for example sickle cell disease, Duchenne muscular dystrophy, Huntington's disease, and even many cancers. Our hope is that this advance will take us another step toward making CRISPR an effective and practical approach to treatment." The researchers applied the new method to mice, seeking to reduce the presence of a gene coding for PCSK9, the loss of which is associated with lower LDL cholesterol, and reduced risk of cardiovascular disease. "The lipid nanoparticles are one of the most efficient CRISPR/Cas9 carriers we have seen," said Ming Wang, also co-corresponding author of the study and professor at the Chinese Academy of Sciences, Beijing National Laboratory for Molecular Science. "We can actually knock down PCSK9 expression in mice with 80 percent efficiency in the liver, suggesting a real promise for therapeutic applications." In addition to the authors quoted above, the study was led by Ji Liu, graduate student and first author, of the Chinese Academy of Sciences, Institute of Chemistry, along with co-authors Jin Chang, Ying Jiang, Lanqun Mao, professors of the Chinese Academy of Sciences, and Xiandi Meng, and Tianmeng Sun from The First Hospital and International Centre of Future Science, Jilin University.

Science Daily, 12 July 2019

<http://www.sciencedaily.com>

What happens when you explode a chemical bond?

2019-07-17

On bright summer days, the sunlight all around us is breaking bad by breaking bonds. Chemical bonds. Ultraviolet light shatters the links

UC Berkeley scientists are probing the fleeting steps in rapid photochemical reactions with some of the shortest laser pulses possible today.

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between atoms in the DNA of our skin cells, potentially causing cancer. UV light also breaks oxygen bonds, eventually creating ozone, and cleaves hydrogen off other molecules to leave behind free radicals that can damage tissue. University of California, Berkeley, chemists using some of the shortest laser pulses available—one quintillionth of a second—have now been able to resolve the step-by-step process leading to the exploding of a chemical bond, essentially making a movie of the event. They can follow electrons indecisively bouncing around in various states in the molecule before the bond breaks, and the atoms go their separate ways. The technique, reported last week in the journal *Science*, will help chemists understand and potentially manipulate chemical reactions stimulated by light, so-called photochemical reactions. Chemists and biologists, in particular, are interested in understanding how large molecules manage to absorb light energy without breaking any bonds, as happens when molecules in the eye absorb light, giving us vision, or molecules in plants absorb light for photosynthesis. “Think about a molecule, rhodopsin, in the eye,” said first author Yuki Kobayashi, a UC Berkeley doctoral student. “When light hits the retina, rhodopsin absorbs the visible light, and we can see things because rhodopsin’s bond’s conformation changes.” In fact, when the light energy is absorbed, a bond in rhodopsin twists, instead of breaks, triggering other reactions that result in the perception of light. The technique Kobayashi and his UC Berkeley colleagues, professors Stephen Leone and Daniel Neumark, developed could be used to study in detail how this light absorption leads to twisting after the molecule passes through an excited state called an avoided crossing or conical intersection. To prevent the breaking of a bond in DNA, “you want to redirect the energy from dissociation to just being vibrationally hot. For rhodopsin, you want to redirect the energy from vibrating to a cis-trans isomerization, a twist,” Kobayashi said. “These redirections of chemical reactions are happening ubiquitously around us, but we have not seen the actual moment of them before.” Attosecond lasers—an attosecond is a billionth of a billionth of a second—have been around for about a decade and are used by scientists to probe very fast reactions. Since most chemical reactions occur rapidly, these fast-pulse lasers are key to “seeing” how the electrons that form the chemical bond behave when the bond breaks and/or reforms. Leone, a professor of chemistry and of physics, is an experimentalist who also uses theoretical tools and is a pioneer in using attosecond lasers to probe chemical reactions. He has six of these X-ray and extreme ultraviolet (collectively, XUV) lasers in his UC Berkeley laboratory. Working with one of the simplest of molecules, iodine monobromide (IBr)—which is one iodine atom linked to one bromine atom—the UC Berkeley team hit the

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molecules with an 8-femtosecond pulse of visible light to excite one of their outermost electrons, then probed them with attosecond laser pulses. Pulsing the attosecond XUV laser at timed intervals of 1.5 femtosecond (a femtosecond is 1,000 attoseconds), much like using a strobe light, the researchers could detect the steps leading to the breakup of the molecules. The high-energy XUV laser was able to explore the excited energy states relative to the molecule's inner electrons, which normally do not participate in chemical reactions. "You are kind of making a movie of the pathways of the electron when it approaches the crossing and the probability of it going along one path or along another," Leone said. "These tools we are developing allow you to look at solids, gases and liquids, but you need the shorter time scales (provided by an attosecond laser). Otherwise, you only see the beginning and the end, and you don't know what else happened in between." The experiment showed clearly that the outer electrons of IBr, once excited, suddenly see a variety of states or places they could be and explore many of them before deciding which path to take. In this simple molecule, however, all paths lead to the electron settling on either iodine or bromine and the two atoms flying apart. In larger molecules, which the team hopes soon to explore, excited electrons would have more choices, some where the energy goes into a twist, like with rhodopsin, or into molecular vibration without the molecules breaking apart. "In biology, it turns out that evolution has selected things that are extremely effective at absorbing the energy and not breaking a bond," Leone said. "When something goes wrong in your chemistry is when you see diseases cropping up."

Phys.org, 11 July 2019

<http://phys.org>

New superomniphobic glass soars high on butterfly wings using machine learning

2019-07-17

Glass for technologies like displays, tablets, laptops, smartphones, and solar cells need to pass light through, but could benefit from a surface that repels water, dirt, oil, and other liquids. Researchers from the University of Pittsburgh's Swanson School of Engineering have created a nanostructure glass that takes inspiration from the wings of the glasswing butterfly to create a new type of glass that is not only very clear across a wide variety of wavelengths and angles, but is also antifogging. The team recently published a paper detailing their findings: "Creating Glasswing-Butterfly Inspired Durable Antifogging Omniphobic

Researchers from the University of Pittsburgh's Swanson School of Engineering have created a nanostructure glass that takes inspiration from the wings of the glasswing butterfly to create a new type of glass that is not only very clear across a wide variety of wavelengths and angles, but is also antifogging.

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Supertransmissive, Superclear Nanostructured Glass Through Bayesian Learning and Optimization” in *Materials Horizons*. They recently presented this work at the ICML conference in the “Climate Change: How Can AI Help?” workshop. The nanostructured glass has random nanostructures, like the glasswing butterfly wing, that are smaller than the wavelengths of visible light. This allows the glass to have a very high transparency of 99.5% when the random nanostructures are on both sides of the glass. This high transparency can reduce the brightness and power demands on displays that could, for example, extend battery life. The glass is antireflective across higher angles, improving viewing angles. The glass also has low haze, less than 0.1%, which results in very clear images and text. “The glass is superomniphobic, meaning it repels a wide variety of liquids such as orange juice, coffee, water, blood, and milk,” explains Sajad Haghanifar, lead author of the paper and doctoral candidate in industrial engineering at Pitt. “The glass is also anti-fogging, as water condensation tends to easily roll off the surface, and the view through the glass remains unobstructed. Finally, the nanostructured glass is durable from abrasion due to its self-healing properties—abrading the surface with a rough sponge damages the coating, but heating it restores it to its original function.” Natural surfaces like lotus leaves, moth eyes and butterfly wings display omniphobic properties that make them self-cleaning, bacterial-resistant and water-repellent—adaptations for survival that evolved over millions of years. Researchers have long sought inspiration from nature to replicate these properties in a synthetic material, and even to improve upon them. While the team could not rely on evolution to achieve these results, they instead utilized machine learning. “Something significant about the nanostructured glass research, in particular, is that we partnered with SigOpt to use machine learning to reach our final product,” says Paul Leu, Ph.D., associate professor of industrial engineering, whose lab conducted the research. Dr. Leu holds secondary appointments in mechanical engineering and materials science and chemical engineering. “When you create something like this, you don’t start with a lot of data, and each trial takes a great deal of time. We used machine learning to suggest variables to change, and it took us fewer tries to create this material as a result.” “Bayesian optimisation and active search are the ideal tools to explore the balance between transparency and omniphobicity efficiently, that is, without needing thousands of fabrications, requiring hundreds of days.” said Michael McCourt, Ph.D., research engineer at SigOpt. Bolong Cheng, Ph.D., fellow research engineer at SigOpt, added, “Machine learning and AI strategies are only relevant when they solve real problems; we are excited to be able to collaborate with the University of Pittsburgh to bring the power of Bayesian active learning to a new

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application.” “Creating Glasswing-Butterfly Inspired Durable Antifogging Omniphobic Supertransmissive, Superclear Nanostructured Glass Through Bayesian Learning and Optimisation” was co-authored by Sajad Haghanifar, and Paul Leu, from Pitt’s Swanson School of Engineering; Michael McCourt and Bolong Cheng from SigOpt; and Paul Ohodnicki and Jeffrey Wuenschell from the U.S. Department of Energy’s National Energy Laboratory.

Phys.org, 11 July 2019

<http://phys.org>

New system ensures traceability in the textile industry

2019-07-17

How can a garment’s origin be derived in a safe and credible way? How can the producer guarantee that it has been produced in a socially, environmentally and economically sustainable way? Now, a new, secure traceability system has been developed in a research project at the University of Borås. Information asymmetry, counterfeits, and lack of transparency—in one-word lack of traceability—is a major challenge in the global textiles and clothing supply chain. QR codes and RFID chips are currently used as traceability tools. However, these are easy to copy. Tarun Kumar Agrawal, during his doctoral studies in textile management at the Swedish School of Textiles, University of Borås, has developed a new traceability system to solve this. “The textile supply chain is a complex network and a lot can happen in the process between the various production lines or stages—from the production of fibre and yarn and on to weaving or knitting the textile, the garment production, the transportation to the retailers, and finally to the consumer. Moreover, consumers want to know where the garment they buy come from, what it is made of, and if it is ethically produced. At the same time, the producers want to show, that their products keep promised quality and are sustainable, and they want to be able to protect themselves from counterfeiting,” he says.

At the product level: Unique cryptotag printed on the garment

In his project, Tarun Kumar Agrawal has looked at traceability at the information and product levels, and how it can be ensured that the information passing the systems is reliable. He has also developed a unique cryptotag that is printed on the finished garment. “The tag contains tiny particles, which randomly form a unique pattern. By image reading it is possible to identify these patterns, similar as when identifying

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a fingerprint. The new traceability system then connects data to the tag," he explains. The tag has been developed and tested at the lab scale and shows promising results on durability, for example washability, abrasion resistance and stretchability. "It is important that the tag is durable and that the particles, that form the unique pattern, consist and can be read off. This is also important when the garment is worn out and goes to recycling, in order to be able to deduce what material the textile consists of, for example, if it is pure or mixed material," he continues.

At the information level: Block chain technology use

The traceability system has been developed to be completely open, so that the stakeholders, who are connected to it, can follow what is happening, from production of raw material to finished garment, and further out to the customer, through the entire supply chain. "The system lacks central authority, which means that there is no individual party that owns and verifies the information transfer. Instead, so-called block chain technology has been used, which is the same technology behind virtual currency transactions, such as bitcoin, to make the information transfer secure. This reduces the risk of the information being manipulated by one single party. Since the system is open to all connected stakeholders, they can follow the production process all the way. The technology helps to develop a technology-based trust among the stakeholders. And, the customer can further know the history of the garment using the system," he says. The traceability system is very promising, and the next step is to scale it up, and to improve the algorithm that has been used. "Now we look forward for cooperation with some companies to try and test the system on their supply chains." Sustainable development has been a fundamental aspect of the project. "Investing in the infrastructure is crucial for the industry—to implement sustainable development, as well as taking responsibility for the production and consumption. With control and transparency of the supply chain for the production of textiles and garments, it will also be possible to actualise reduced climate impact. Global partnerships are the main key in the work for sustainable development," concludes Tarun Kumar Agrawal.

Phys.org, 15 July 2019

<http://phys.org>

Researchers say the best way to extend the life cycle of roads, and keep future costs down, is to increase the thickness of asphalt on certain roads.

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Thicker pavement is more cost effective down the road

2019-07-17

As the summer months heat up, so will the asphalt and other materials used to make roads. Pavements, which are vulnerable to increased temperatures and excessive flooding due to sea level rise, can crack and crumble. Climate change can be a major contributor and as greenhouse gas emissions continue, which scientists say have caused an increase in global temperatures since the mid-20th century, these issues are projected to accelerate. Researchers at the University of New Hampshire say because of this one of the best ways to extend the life cycle of roads, and keep future costs down, is to increase the thickness of asphalt on certain roads. "It's all about being strategic with the maintenance of our highways and byways," says Jo Sias, professor of civil and environmental engineering. "Just like a regular oil change can help extend the life of a car, our research shows regular maintenance, like increasing the asphalt-layer thickness of some roads, can help protect them from further damage related to climate change." In their study, recently published in the journal *Transportation Research Record*, the researchers looked at the seasonal and long-term effects on pavement life, like climate-change-induced temperature rise and higher groundwater levels due to sea level rise and heavy rains. They looked at the changes in season length, increased flooding, average temperatures, projected temperatures and resilience based on those temperatures. As global temperatures continue to rise, road conditions will shift. The winter pavement season is projected to end by mid-century, replaced by a longer fall season. Pavement damage, now seen mostly in the spring and summer, is projected to be more distributed throughout the entire year. Based on their analysis that looked at the wear and tear of roads, the researchers determined that a 7% to 32% increase in the asphalt-layer thickness might be the best way to maintain the service ability of some roads. "For agencies and towns, it is a balancing act to repair roads so we're trying to find some reasonable action that can be taken now to help manage their infrastructure," said Sias. "If global warming continues then we know temperatures will rise and pavement doesn't respond well to increased temperatures. The hope is to find some answers now so cities and towns can plan for the future." The researchers recognise that increasing the asphalt thickness to certain roads can be an added expense for cities and towns but they point to considerable future savings of between 40% and 50% if done now rather than later. Along with the rise in cost of materials, there could also be other expense increases down the road like project planning, design, and construction. Environmental impacts could also be costly with rough

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pavements adding to increased greenhouse gas production, which has the potential to accelerate climate change. While the study looked specifically at the impact of the changing pavement seasons and the increase in temperatures and flooding at a site in coastal New Hampshire, the researchers say the approach has the potential to be applied to most roads and highways both nationally and globally. The adaptation approach, of calculating the pavement layer thickness required to maintain a safe road reliability level, could provide the guidance to address the effects of rising temperatures and changing seasons on those byways. Funding for this research was provided by National Science Foundation (NSF), New Hampshire Sea Grant, N.H. Department of Transportation and N.H. Department of Environmental Services.

Science Daily, 10 July 2019

<http://www.sciencedaily.com>

Fluorine speeds up two-dimensional materials growth

2019-07-17

Back in 2004, the physics community was just beginning to recognise the existence of truly two-dimensional (2D) material, graphene. Fast forward to 2019, scientists explore a breadth of different 2D materials, expecting to uncover more of their fundamental properties. The frenzy behind these new 2D materials lies in their fascinating properties: materials thinned down to only a few atoms work very differently from their 3D version. Electrons packed into the thinnest-ever layer show distinctive characteristics apart from being in a "loose net." Also being flexible, 2D materials could feature distinctive electrical properties, opening up new applications for next-generation technologies, such as bendable and wearable devices. Then, what is the catch? Many parameters such as temperature, pressure, precursor type, and flow rate need to be factored into the CVD synthesis of 2D materials. With multiple reactions involved, it is extremely difficult to optimize all these factors during the reactions and find their best combinations. That being said, 2D material synthesis is hardly controllable. Scientists have tried to accelerate the growth of 2D materials by adopting different substrates, feedstocks, or temperature. Still, only a few types of 2D materials can be synthesised into large area high quality films. Scientists from the Centre for Multidimensional Carbon Materials (CMCM), within the Institute for Basic Science (IBS) at the Ulsan National Institute of Science and Technology (UNIST), in cooperation with researchers at Peking University (PKU), and University of Electronic Science and Technology of China (UESTC), demonstrated that fluorine, having

By spatially confining fluorine, scientists could activate feeding gases while disabling its harmful effects

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the strongest tendency to attract electrons (i.e. electronegativity) in all elements, can speed up the chemical reaction to grow three representative 2D materials; graphene, h-BN, and WS₂. Fluorine requires only one electron to attain a high stability. Also, having seven electrons in the outermost orbit of an atom, the distance at which these valence electrons reside is the minimum compared with other elements. This means the valence electrons of fluorine are bound to the atom more strongly than any other atom making fluorine the most active element in the periodic table. In fact, active gases such as hydrogen or oxygen are broadly used to tune the growth of graphene and other 2D materials. "Why not then the most active element, fluorine? The highest electronegativity allows fluorine to form bonds with nearly all the atoms in the periodic table, so it is expected to change the reaction routes of many chemical processes," said Professor Feng Ding, the corresponding author of this study.

Experimentally, it is not preferable to introduce fluorine during a material's growth as fluorine gets highly toxic in the reactor. To resolve the problem, instead of using fluorine gas directly, the scientists spatially confined the fluorine supply so that only the minimum amount of fluorine is consumed. They placed a metal fluoride substrate (MF₂) below a Cu foil with a very narrow gap in between. At a high temperature, fluorine radicals are released from the fluoride surface and spatially trapped in the narrow gap between the Cu foil and the metal fluoride substrate. Surprisingly, such a simple change leads to a record growth rate of graphene at 12 mm per minute. To put this rate in perspective, this new approach reduces the time of growing a 10 cm² graphene from 10 minutes with previous methods, now down to only 3 minutes. The introduction of local fluorine entirely changes the methane decomposition route. As the fluorine released from the metal fluoride surface easily reacts with methane gas, there will be a sufficient amount of CH₃F or CH₂F₂ molecules in the gap between Cu and BaF₂ substrates. These molecules could decompose on a Cu surface much more easily than CH₄ does. In other words, they feed the graphene growth better by supplying more active carbon radicals (i.e. CH₃, CH₂, CH and C). Further experimental studies showed that the local fluorine supply strategy could greatly accelerate the growth of other 2D materials, such as h-BN and WS₂, as well. The scientists investigated how spatially confined fluorine is able to accelerate the growth of 2D materials. Theoretical studies revealed that fluorine, being highly reactive readily interact with methane molecules. The existence of fluorine leads to the formation of CH₃F or CH₂F₂ molecules. These highly active molecules can then be more easily decomposed on the Cu foil surface, which greatly accelerates the carbon supply for fast graphene growth. Although the detailed mechanism of fluorine boosting the growth of h-BN and WS₂ is not clear,

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the authors are confident that the presence of fluorine could significantly modify the reactions of 2D materials' growth. "We envision that this local fluorine supply will readily facilitate fast growth of broad 2D materials or enable the growth of new 2D materials which is very difficult to be realised by other methods," noted Professor Feng Ding. In addition to the fluoride, there are abundant kinds of substrates like sulphides, selenides, chlorides or bromides that might be used as local supply sources of different active materials, which provides wide enough platform to modulate the growth of broad 2D materials.

Science Daily 15 July 2019

<http://www.sciencedaily.com>

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Blue light at night increases the consumption of sweets in rats

2019-07-18

A new study demonstrates that just one hour of exposure to blue light at night—the kind of light produced by the screens of many devices—raises blood sugar levels and increases sugar consumption in male rats. This study, led by Anayanci Masís-Vargas and colleagues from the University of Strasbourg and University of Amsterdam, was presented this week at the annual conference of the Society for the Study of Ingestive Behavior (SSIB) in Utrecht, Netherlands. Previous research has shown a strong correlation between obesity and the levels of artificial light at night. Much of the artificial light we are now exposed to comes from LED lights and LED screens, which emit high levels of blue light. Retinal cells of the eye are sensitive to this blue light and directly convey information to areas of the brain that regulate appetite. In their study, Masís-Vargas and colleagues, exposed rats to night-time blue light and measured their food consumption and glucose tolerance the following day. It should be noted that, in order to better model human light exposure, the rats used in this study were diurnal, meaning awake during the day and asleep at night, rather than the typical nocturnal laboratory rats which are awake during night-time hours. The authors found that after only one hour of nocturnal blue light exposure, glucose tolerance was altered in male rats, a warning sign of pre-diabetes. To investigate what happens with appetite control and food choice after exposure to blue light at night, the rats were given the option to choose among a nutritionally balanced food (standard rodent food), water, lard, and sugar water. After the exposure to blue light, they observed that the male animals drank more sugar that night than during the nights with no blue light exposure. These studies show clearly that being exposed to light, especially blue light, at night is disruptive, and that screen use at night may increase the tendency to snack on sugary foods and disrupt the ability to process sugar, especially in males. Though the rats were tested after only one night of light exposure, over time, this could lead to weight gain and the development of diabetes. “Limiting the amount of time that we spend in front of screens at night is, for now, the best measure to protect ourselves from the harmful effects of blue light. In case it is necessary to be exposed to devices at night, I would recommend the use of apps and night mode features on the devices, which turn the

A new study demonstrates that just one hour of exposure to blue light at night—the kind of light produced by the screens of many devices—raises blood sugar levels and increases sugar consumption in male rats.

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screens more orange and less blue or the use of blue light filtering goggles that are already available in the market.” Masís-Vargas says.

Medical Xpress, 9 July 2019

<http://medicalxpress.com>

Nutrient runoff starves corals in the Florida Keys

2019-07-18

Rising ocean temperatures, a consequence of climate change, are known for bleaching and killing corals. But a study, published today in *Marine Biology*, reveals another overlooked culprit: excess nitrogen. Between 1984 and 2014, researchers from the Florida Atlantic University studied Looe Key, a reef off the Florida Keys. Three decades of data gave them an unprecedented look at the shifting quality of marine waters. Run-off from the Everglades caused increased levels of nitrogen and algae blooms, which were followed by outbreaks of coral disease, bleaching and death. The study suggests that eutrophication, the excess enrichment of nutrients, played a primary role in causing the coral reefs to decline at Looe Key. These findings come as corals around the world are in dying. So far, more than a quarter of the planet’s reefs are gone. The destruction is most often attributed to ocean acidification and rising temperatures, both the result of climate change, however, the new research suggests there could be more at play in certain regions. Brian LaPointe, the new study’s lead author, wondered about nutrient runoff—which comes from sewage, fertilizers and topsoil— when he moved to Florida in the early ‘80s. The state population was increasing, and he speculated that more nutrients would be washing into the ocean as a result. Too much runoff causes algae blooms, which choke out sunlight and deplete oxygen for other species. “We thought we should start a water monitoring program,” LaPointe told EHN. Timing was important. When they began the study in 1984, water quality in the Keys was still “relatively good,” LaPointe said. But starting in 1980, Florida invested in a plan to move freshwater from the north down to the Everglades, which are adjacent to the Florida Keys. Proponents thought Florida Bay needed more freshwater in order to prevent algae blooms. “In fact, it was just the opposite: it was feeding the blooms,” LaPointe said. As freshwater flowed into Florida Bay, thousands of tons of nitrogen came with it. Between 1984 and 2014, LaPointe and other researchers documented three time periods when excess nitrogen triggered coral bleaching, disease and death. In 1984, corals covered one third of the Looe Key Sanctuary Preservation Area. By 2008, they only covered 6 percent. The researchers saw a pattern: more corals died

Too much nitrogen killed off corals in the Keys, and, as reefs suffer around the world, this new research offers lessons learned in Florida that could save other nutrient-loaded corals

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between 1985 to 1987, then again from 1996 to 1999, after heavy rains and when Florida implemented projects to move freshwater to the Everglades. "We warned resource managers about the perils of sending water south, knowing it was going to increase nitrogen loading and algae blooms," LaPointe said. "But we didn't have all the information in detail about how the corals would get stressed." Corals normally thrive in low-nutrient waters. Excess nitrogen can throw an ecosystem out of whack. But it isn't the sheer amount of nitrogen that disrupts corals: it's actually the ratio of nitrogen to phosphorus. When that ratio increases, it starves corals of phosphorus. In a lab setting, researchers have played with the ratio, demonstrating that it can make corals deficient in phosphorus. "But our study put it in an ecological context, showing how this story has played out three times in a row," LaPointe said. LaPointe also sees nutrient enrichment affecting corals on other reefs. At the Bonaire coral reefs in the Caribbean Netherlands, nearby hotels previously used septic tanks. Those reefs are finally beginning to recover, only after the island switched to a new wastewater treatment plant in 2011. "It's one of the first examples in the Caribbean where by improving the water quality, they have turned a dying reef into a recovering reef," LaPointe said. "We need more examples of that." LaPointe sees these results as promising: Unlike the daunting task of curbing carbon emissions, communities can reduce nitrogen runoff at a local scale. "There's something we can do about this, and we're already doing something about it in the Florida Keys," LaPointe said. Improvements include updating sewer systems with better waste treatment. Using less fertilizer and treating stormwater could also help. "But it's going to take time. It took decades for this reef to die off. It's not going to come back overnight."

Environmental Health News, 15 July 2019

<http://www.environmentalhealthnews.org/>

Climate Deniers Are Spreading a Totally Unscientific "Paper" With No Basis in Reality

2019-07-18

Those who persist in denying the reality of human-caused climate change have resorted to scraping the very bottom of the barrel. Last week, climate deniers at several blogs and news outlets jumped on a new "paper" that supposedly "proves" the vast majority of climate scientists are wrong. Except, according to a scientific review from the independent fact-checking organisation Climate Feedback, the document does no such thing. The widely shared paper, which claims to overturn decades

Those who persist in denying the reality of human-caused climate change have resorted to scraping the very bottom of the barrel.

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of scientific findings, is not published in a peer-reviewed journal, but can be found on the pre-print website arXiv. As Climate Feedback's expert summary reveals, the scant PDF is riddled with problems, and doesn't provide any sources to the data it claims to examine. The manuscript makes the extraordinary claim that human-made climate change does not exist in practice. But scientists who contributed to the scathing Climate Feedback analysis point out that the document cherry picks information and relies on circular reasoning. "This text may look like a scientific article to a lay-person, but I would not accept it as a bachelor thesis," comments Victor Venema, a climate scientist at the University of Bonn, Germany, as part of Climate Feedback's review. "It does not cite its data sources, it does not discuss the uncertainties in the data, nor does it discuss that other cloud data sets find the opposite trend." Dismissing an entire body of climate science, the six-page document cites a mere six references: four of which are the authors' own and two of which are unpublished. Mark Richardson, a physicist and research assistant at NASA and the University of California, further pointed out that the authors of this new study - one of whom is a self-professed clexit-er, or climate exit-er - rely on "a bunch of nonsense calculations" to show that only 0.1 °C of warming is from CO₂, while 90 percent is caused by the oceans. "This violates conservation of mass from basic chemistry," he writes for Climate Feedback, "the oceans are actually absorbing CO₂, which, again, is the complete opposite of what Kaupinen and Malmi claim. Without claiming the opposite of reality, their conclusions cannot be supported." Despite the myriad flaws in the manuscript, many media personalities with a climate change denying agenda simply ran with it, not bothering to independently verify the science or fact-check the claims. For example, Rowan Dean, a climate-denying commentator at Sky News Australia - which is, it must be noted, owned by Rupert Murdoch - used the unsubstantiated document as fuel for his own verbal rampage. "Climate change is a fraudulent and dangerous cult, which has paralysed and bewitched the ruling elites, and is driven by unscrupulous and sinister interests including the power-hungry socialist mob at the UN," said Dean. "The websites that have promoted this paper provide no counterpoint or basic fact-checking on the bold claims made by the authors," Stephen Po-Chedley, an atmospheric scientist at the University of California, commented for Climate Feedback. Thankfully, there's no shortage of actual climate scientists who can set the record

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straight. You can read the entire summary and all expert comments over at Climate Feedback.

Science Alert, 16 July 2019

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

Elephants help forests store more carbon by destroying smaller plants

2019-07-18

Elephants do a lot of damage to plants as they stomp around the jungle, but, counterintuitively, this activity increases the biomass of the forest, letting it store more carbon. If elephants were to go extinct, the amount of carbon stored in central African rainforests could ultimately fall by 7 per cent, according to a new analysis. There are thought to have been around a million elephants in these forests in the early 19th century, but there are now only about 100,000. These animals graze and trample on trees smaller than 30 centimetres in diameter – plants that are subject to a lot of competition for light, water and space. Fabio Berzaghi at the Laboratory of Climate and Environmental Sciences in Gif-sur-Yvette, France, and his colleagues wondered if elephants' destructive habits might allow surviving trees to grow larger by eliminating their competition. They built a mathematical model of plant diversity and simulated the impact of elephants by increasing the mortality of smaller plants.

Slow-growth boost

The model showed that elephants reduce the density of stems in the forest, but increase the average tree diameter and the total biomass. Overall, they favour slow-growing trees that live longer and store more carbon in their trunks. "If elephants promote these kinds of trees, in the long run you will store more atmospheric carbon in trees," says Berzaghi. The model results fit with data from sites in the Congo basin where elephants live and comparable areas that are undisturbed by elephants. These effects may also account for the differences between African and Amazonian rainforest. In the Amazon, where there are no large herbivores, the number of trees per hectare is higher, but they tend to be smaller and hold less biomass in total. "We think that large herbivores have contributed to these differences," says Berzaghi.

Carbon savings

If elephants were to go extinct, the amount of carbon stored in central African rainforests could ultimately fall by 7 per cent, according to a new analysis.

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Because these large trees are so long-lived, the sharp decline of the elephant population over the past two centuries will take a long time to remodel the forest. However, the study estimates that, in due course, the loss of elephants will reduce the biomass of African forests by about 3 gigatonnes of carbon. That's equivalent to 14 years' worth of carbon emissions from the UK. "Globally, this is a contribution to the problem, but since it's a complex problem and this is a completely free service, I think it's quite important," says Berzaghi. Elephants have other helpful roles in these ecosystems, he adds, such as distributing seeds and nutrients that help forests to grow faster.

New Scientist, 15 July 2019

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

The US Air Force Has a Warning For The 1.1 Million People Wanting to Storm Area 51

2019-07-18

Should everything go according to plan, more than 1.1 million strangers will gather in a remote Nevada town in mid-September, united by a common goal: to raid Area 51 in the wee hours of the morning — using a strength-in-numbers approach to reveal any extraterrestrial treasures stashed within the notoriously clandestine government base. Or, put more simply: "Lets see them aliens [sic]." By Monday evening, more than 1 million people from around the world had signed up to attend the joke Facebook event: "Storm Area 51, They Can't Stop All of Us" — and almost as many had indicated they were "interested." Planned for September 20 in Amargosa Valley, an hour's drive from Las Vegas, the event page is filled with thousands of satirical posts and memes theorizing the best way to break into the top-secret facility. "We will all meet up at the Area 51 Alien Centre tourist attraction and coordinate our entry," reads a brief description of the event, which was created by popular video game streamer SmyleeKun. "If we naruto run, we can move faster than their bullets." The latter part of the description references anime ninja Naruto Uzumaki, whose signature head-forward, arms-behind-the-back running technique has led some to believe it makes them run faster. (It doesn't.) Most people discussing the raid, including various news outlets that have written about the event, recognise that it's not intended to be taken seriously. But what about those who don't? It's not clear exactly how many people — if any — will actually show up to lead a blitzkrieg on the Nellis Air Force Base Complex, which houses the land containing Area 51. Though some who've posted on the event page in recent days

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have considered that possibility. "P.S. Hello US government, this is a joke, and I do not actually intend to go ahead with this plan," wrote user Jackson Barnes, following his rather descriptive proposed game plan. "I just thought it would be funny and get me some thumbsy uppies on the Internet. I'm not responsible if people decide to actually storm area 51." Speaking with The Washington Post recently, Air Force spokeswoman Laura McAndrews said officials were aware of the event. When asked how authorities would respond to ardent explorers who might attempt to enter Area 51 in September, McAndrews said she could not elaborate on specific plans or security procedures at the base. She did, however, issue a warning to those itching to try their luck. "[Area 51] is an open training range for the US Air Force, and we would discourage anyone from trying to come into the area where we train American armed forces," McAndrews said. "The US Air Force always stands ready to protect America and its assets." The facility has long been a source of public intrigue, yet for decades, Americans were told Area 51 didn't exist at all. That notion was officially debunked in 2013 when the CIA confirmed its existence through documents obtained in a public records request by George Washington University. Yes, Area 51 is definitely real — and even though the report indicated it was nothing more than an aircraft-testing facility, mentioning nothing about extraterrestrial life, the revelation gave credence to conspiracy theories alleging the government uses the base to hide aliens and their spacecraft. The CIA has since published information about test flights that took place there, and the alien aspects in many of those theories have been debunked. However, in 2017, the Pentagon confirmed the existence of a US\$22 million government program to analyse "anomalous aerospace threats" — also known as UFOs — giving the alien-obsessed kooks fresh fodder for their conjectures. Though the facility is not publicly accessible, the area around Area 51 is a popular tourist destination, sprinkled with alien-themed motels, museums and restaurants. (In 1996, Nevada renamed state Route 375 to "Extraterrestrial Highway.") But those who venture too far into the land surrounding the base are greeted with warning signs indicating they could be fined or jailed for trespassing and taking photos. Some signs suggest those who enter could be subject to "deadly force." In 2014, a tour bus carting four passengers near Area 51 inadvertently drove through the warning signs and entered the base, Las Vegas Now reported. The truck was stopped by men in "military garb," and everyone in the vehicle was threatened with a misdemeanour conviction and \$650 fine. The incident was caught on video, making it obvious the tour's passengers thought it was all part of the experience. Only the driver was charged. Of course, those who say they will participate in the September raid know their mission won't be easy. Some have offered their

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own plans and even schematics detailing how the group will take on the base.

Science Alert, 16 July 2019

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

Anorexia is a metabolic disorder as well as a psychiatric one

2019-07-18

Anorexia nervosa isn't just a psychiatric condition – it is a metabolic one, too, according to a genetic study of around 72,500 people. The findings help to explain some of the symptoms of anorexia, and could help to shape future treatments. Anorexia affects between 0.9 and 4 per cent of women and 0.3 per cent of men, but is still poorly understood. "Anorexia has the highest mortality rate of any psychiatric disorder," says Cynthia Bulik at the University of North Carolina at Chapel Hill. "We're not very good at treating anorexia. There's no medication, and that's probably because we don't understand the underlying causes." Previous research has found that genetic factors, as well as environmental ones, can increase a person's risk of anorexia. To investigate, Bulik and her colleagues compared the genomes of just under 17,000 people with anorexia with those of 55,500 people who didn't have the condition. The team used a technique that applies thousands of markers to the genome, and compares these markers across all the volunteers. "It points you to where in the genome the differences lie," says Bulik.

Genetic associations

The search pinpointed eight locations across the genome that seem to play a role in anorexia. But this is likely to represent only a tiny fraction of all the genetic factors involved in the condition, says Bulik. "It's a complex trait, so we expect lots of genes to each have a small to moderate effect," she says. The researchers compared their results with similar genetic studies of other traits, ranging from other psychiatric conditions to weight, education and personality. They found that anorexia seems to be correlated with obsessive compulsive disorder and depression, suggesting that these all share genetic factors. This makes sense, says Bulik – people with these conditions often show similar symptoms. The team also found a genetic correlation between anorexia and high physical activity. "We know that people with anorexia have a really hard time sitting still," says Bulik. Doctors had tended to think that this was a psychological

Anorexia nervosa isn't just a psychiatric condition – it is a metabolic one, too, according to a genetic study of around 72,500 people.

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symptom – that those individuals were still trying to lose weight. But this study suggests there is some genetic drive to move, says Bulik. The team also found correlations with BMI, body fat, insulin resistance and levels of HDL cholesterol, which is known as “good cholesterol”. “Those things combined suggest that anorexia nervosa seems to be both a psychiatric and a metabolic disorder,” says Gerome Breen at King’s College, London, who worked with Bulik on the study.

Part of the puzzle

“It’s a very exciting advance in our understanding of the genetics of the disorder,” says Dolores Malaspina at the Icahn School of Medicine at Mount Sinai in New York. “It may suggest other ways beyond psychological ones to help people gain weight.” But Malaspina cautions that the latest genetic clues are only a small part of the puzzle of anorexia. “The benefit of a large study sample size is that you are more likely to find a common genetic variant, but the trade-off is that it explains a smaller piece of any individual’s picture,” she says. Given the complexity of the condition, there are likely to be varying subtypes – some people may have more of a psychiatric condition while others might have more of a metabolic type, says Bulik. She hopes that, in the future, genetic tests might diagnose a subtype, and help tailor a person’s treatment. Bulik also hopes that the findings will help to reduce the stigma and misunderstanding of anorexia. Family doctors can still blame the parents of someone with the condition, or accuse girls with anorexia of being vain and wanting to look like models, she says. And even today, boys and men are told they can’t have anorexia, because it is a “girl’s disorder”, she says. “I hope this changes the way people think about this illness,” says Bulik. “We are on a path to reconceptualising anorexia.

Science Alert, 15 July 2019

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

E.P.A. Broke Rules in Shake-Up of Science Panels, Federal Watchdog Says

2019-07-18

The Trump administration failed to follow ethics rules last year when it dismissed academic members of Environmental Protection Agency advisory boards and replaced them with appointees connected to industry, a federal watchdog agency concluded recently. The agency, the Government Accountability Office, found that the administration “did

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not consistently ensure” that appointees to E.P.A. advisory panels met federal ethics requirements. It also concluded that Trump administration officials violated E.P.A. guidelines by not basing the appointments on recommendations made by career staff members. Scott Pruitt, President Trump’s first E.P.A. administrator who resigned last year amid ethics scandals, remade the agency’s science advisory panels because he said they did not fairly represent the United States geographically, or the industries affected by regulations. The percentage of academic scientists serving on one E.P.A. panel, the Scientific Advisory Board, dropped 27 percent during the first year of the Trump administration. Academics on the agency’s Board of Scientific Counsellors dropped 45 percent. Investigators found that the percentage of academics on E.P.A. advisory boards remained stable around 83 percent during the first year President Barack Obama was in office. About 23 percent of the financial disclosure forms that the accountability office reviewed for the new members were incomplete. In more than half of all cases, auditors were unable to determine whether an ethics official had reviewed the member’s disclosure. “E.P.A. also did not consistently ensure that members appointed as special government employees — who are expected to provide their best judgment free from conflicts of interest and are required by federal regulations to disclose their financial interests — met federal ethics requirements,” the report said. It also said the agency “did not follow a key step” in its own rules by failing to document the agency’s rationale for appointing new panel members. Under established procedures, agency staff members are expected to outline their decisions for recommending certain candidates. “This report shows that the Trump administration rigged influential advisory boards to favour its polluter backers,” Senator Sheldon Whitehouse, a Rhode Island Democrat, said in a statement. He called the findings “yet another example of Donald Trump handing the keys to Americans’ government to big industries that government is supposed to police.” The House Science Committee is expected to raise the findings in a hearing. The E.P.A. denied violating guidelines. Michael Abboud, a spokesman for the E.P.A., noted in an email that challenges to the agency’s appointment decisions “have been dismissed in three separate district courts.” “Given the range of environmental and public health considerations across the country, E.P.A. is proud of the fact that its chartered scientific advisory committees have the highest participation of state, local, and tribal experts than at any point in the Agency’s history,” Mr. Abboud said. The G.A.O. report found that Mr. Pruitt remade the panels geographically to include a 25 percent increase in members from the

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South, which the watchdog agency defined as spanning from Delaware to Texas.

New York Times, 15 July 2019

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

'Toxic Stew' Stirred Up by Disasters Poses Long-Term Danger, New Findings Show

2019-07-18

New research shows that the extreme weather and fires of recent years, similar to the flooding that has struck Louisiana and the Midwest, may be making Americans sick in ways researchers are only beginning to understand. By knocking chemicals loose from soil, homes, industrial-waste sites or other sources, and spreading them into the air, water and ground, disasters like these — often intensified by climate change — appear to be exposing people to an array of physical ailments including respiratory disease and cancer. "We are sitting on a pile of toxic poison," said Naresh Kumar, a professor of environmental health at the University of Miami, referring to the decades' worth of chemicals present in the environment. "Whenever we have these natural disasters, they are stirred. And through this stirring process, we get more exposure to these chemicals." Dr. Kumar's research has focused on the spread of PCBs, a suspected carcinogen, in Puerto Rico in the aftermath of Hurricane Maria in 2017. He led a team of researchers in Guánica, a bayside town with historically high concentrations of PCBs, and found that levels had tripled since Maria, to 450 parts per million. Worse, it wasn't just the soil showing elevated PCBs. It was the people, too. The researchers tested 50 residents in Guánica and found levels two to three times greater than the national average. Dr. Kumar's hypothesis is that the PCBs from old industrial sites were pushed into or around the bay, and people ate contaminated fish or breathed contaminated air. Other research examined Hurricane Harvey in Houston, and the wildfires in Northern California, looking at the contaminants dislodged during those disasters and the health effects of those contaminants, which can include sewage, asbestos, heavy metals and others. The issue is a global concern as well. Last year, the World Health Organization issued a report warning about the public-health effects of chemical releases caused by natural disasters, citing examples in Europe, Latin America and Asia. The research is emerging as the United States enters the stretch of summer and fall when the risk of hurricanes and wildfires is greatest, and as officials grapple with how to protect people's health. Seattle recently said it would open facilities where people

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can take refuge from smoke caused by nearby wildfires. In Louisiana, Tropical Storm Barry this weekend has sparked concern about a repeat of the “toxic gumbo” of sewage, chemical waste and other contaminants released when Hurricane Katrina devastated the city of New Orleans more than a decade ago. The toxic substances displaced during disasters “are much more long-lasting and ubiquitous than I think people realise,” said Gina McCarthy, who ran the Environmental Protection Agency during the Obama administration and now directs the Centre for Climate, Health and the Global Environment at Harvard. “And we clearly haven’t caught up in terms of our laws and regulations, and the process of disaster response.” Part of the problem, and the urgency to better understand it, is the ubiquity of chemicals in modern life, according to Thomas A. Burke, who was the E.P.A.’s science adviser during the Obama administration. “All of us have a little toxic warehouse under our sinks, in our garages, and maybe in the construction materials of our homes,” Dr. Burke said. “When you do demolition in this country, there’s a series of local laws to control contaminants. But when a neighbourhood burns down, there’s no asbestos control. There’s no ability to really control the hazardous materials.” The movement of toxic substances by storms and wildfires joins a long list of threats that climate change poses to Americans’ health, whether they be more severe heat waves or the spread of dengue or other ailments previously restricted to the tropics. What makes this threat different, researchers say, is the ability of many contaminants to persist in the environment or in people’s bodies after the disaster has passed, and to accumulate in with each new storm or fire. “Typically with these situations you have a mixture, a toxic stew,” said Aubrey K. Miller, senior medical adviser to the National Institute of Environmental Health Sciences, part of the National Institutes of Health. He said the danger is compounded because the mix of toxins could lead to unexpected interactions. “We’ve been able to demonstrate human health effects in some of these, but that information is not adequately captured.”

That’s beginning to change. Until recently, researchers had been hamstrung by the logistical difficulty of tracking long-term changes in people’s health after a disaster. One of the first cases in which good data was available, Dr. Miller said, was the collapse of the World Trade Centre in the terrorist attacks of September 11, 2001. Researchers have been following a group of more than 71,000 people, including rescue and recovery workers, since 2003. That research showed the severity of health effects linked to exposure to dust from the towers, which included heavy metals, silica, wood dust, asbestos fibres and other contaminants. Ten percent of enrollees developed asthma within six years, and firefighters

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saw drops in lung function. A 2013 paper reported greater-than-expected rates of thyroid and prostate cancer among rescue and recovery workers; a paper published this March showed higher rates of pulmonary fibrosis. What the World Trade Centre data couldn't reveal was whether that event was unique, or if other disasters might similarly spread toxins in a way that could lead to long-term effects. So, in 2010, the N.I.H.'s environmental health sciences institute began awarding research grants quickly after an event and made other changes to make it easier to gather human health data after a disaster. The series of hurricanes and wildfires that began in 2017 led to a burst of those quick-response grants. Several of those researchers, including Dr. Kumar, agreed to discuss their initial findings with The New York Times in advance of the publication of their reports. The researchers said their work has shown health effects that they say have surprised them. One of the grant recipients was Irva Hertz-Picciotto, an epidemiologist and director of the Environmental Health Sciences Centre at the University of California, Davis. After the wildfires that struck Northern California in the fall of 2017, she used an online survey to get health information from thousands of people exposed to the smoke. She wanted to know whether they were still experiencing health effects, and how those effects changed over time. "There's been a conventional wisdom that when people have symptoms from fires, they are transient and there's not persistence," Dr. Hertz-Picciotto said. But her research showed that wasn't the case for the California fires: Months after the initial exposure, about 15 percent respondents who had never had asthma reported asthma-like symptoms. "That's not something that happens every day," she said. "It does go against the grain of the current view of what those impacts are, and how long-term they can be." Dr. Hertz-Picciotto's team also gathered ash from near homes that had burned, and found it contained almost 2,000 chemicals that weren't present in ash gathered from undeveloped areas. She said she suspected exposure to those contaminants explained the high rate of respiratory symptoms months afterward. The other possible explanation is the sheer magnitude of the fires, which means higher temperatures and more contaminants entering people's lungs. "It used to be that a huge fire was 30,000 acres," Dr. Hertz-Picciotto said. "We're talking about 300,000 acres happening regularly now." Other researchers are examining the health effects of contaminants shifted by hurricanes.

In September 2017, after Hurricane Harvey dropped four feet of rain on Houston, dislodging chemicals from the soil, ship channels and chemical facilities, a team from the Baylor College of Medicine distributed health questionnaires to residents. They also took nasal swabs, spit and saliva

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tests and faecal samples to see what toxins were in people's bodies, and distributed silicon wristbands that measure what chemicals the residents were exposed to. "Those three pieces of data have not been done before," said Cheryl Walker, director of Baylor's Centre for Precision Environmental Health and one of the people working on the research. The early results of that research show a range of health reactions, including sinus problems, skin irritation and respiratory ailments, Dr. Walker said. Now those researchers are using geospatial analysis to determine which participants were close to which chemical sites, as well as what contaminants are present in their bodies and homes, to try to link specific toxins to specific health effects. Another group, from Baylor, is examining the health effects of Hurricane Harvey on African-American adults with asthma. Several teams at Baylor studying Harvey's health effects are scheduled to discuss their initial findings next month. As the dangers become better understood, governments need to do more to contain toxic chemicals during disasters, rather than hoping those chemicals will harmlessly be absorbed into the environment, according to Kimberley Miner, a research assistant professor at the University of Maine who studies climate change and contaminants. "When I was growing up, they were still saying the solution to pollution is dilution," Dr. Miner said. "We now know that's absolutely not true."

New York Times, 15 July 2019

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

Toxic air significantly increasing city residents' risk of heart disease

2019-07-18

City residents' hearts could be up to ten times more polluted than those living in places with cleaner air, significantly increasing their risk of heart disease, a study has found. A global team of academics analysed the hearts of 72 people aged between three and 32. Sixty-three of these were taken from the victims of traffic accidents in the heavily polluted Mexico City which were compared with nine hearts from people who had lived in cleaner areas. They found that the hearts belonging to Mexico City residents contained much higher numbers of iron-rich magnetic nanoparticles created from pollution from traffic and industry. When a human heart is exposed to these nanoparticles, it can inflame heart tissues causing damage which could potentially lead to serious problems such as heart disease or heart failure. They also found these nanoparticles in many different cell structures in the left ventricle of the heart, even

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in the mitochondria – which is crucial for supplying the energy needed for the heart to pump effectively. Prior to this study, little was known about the abundance of these metal-rich and magnetic nanoparticles in human heart tissue or what specific damage they could be causing, even in children and young adults. The researchers say their findings provide a new way of understanding heart disease risks and underline the importance of ‘urgent action’ on particulate air pollution controls to protect human health. Professor Barbara Maher from the University of Lancaster co-led the study. She said: ‘Exposure to this type of metal-rich nanoparticle appears to be directly associated with early and significant inflammation and cardiac damage. ‘Identification of billions of strongly magnetic nanoparticles in the hearts of children and young adults provides an important new layer of information for understanding the development of cardiovascular disease.’ Professor Lilian Calderon Garciduenas from the University of Montana added: ‘Exposure to iron-rich, combustion- and friction-derived nanoparticles is a modifiable risk factor for the development of cardiovascular diseases and this new evidence highlights the need for urgent progress in global efforts to reduce exposure to particulate matter air pollution and, specifically, to reduce and regulate the nanoparticles in air pollution.’ In June, a study found that long-term exposure to ambient ozone (O₃) in the air may speed up the development of heart disease such as atherosclerosis.

Air Quality News, 15 July 2019

<https://airqualitynews.com>

U.S. judge slashes Roundup jury award to \$25.3 million; Bayer still plans to appeal

2019-07-18

A federal judge recently slashed a damages award Bayer AG owed a California man who blamed Roundup weed killer for his cancer, to \$25.27 million from \$80.27 million, while rejecting the company’s bid for a new trial. U.S. District Judge Vince Chhabria in San Francisco said evidence against the former Monsanto Co, which Bayer bought last year, supported the \$5.27 million in compensatory damages that a jury awarded Edwin Hardeman. He also said the jury acted reasonably in awarding punitive damages. Chhabria nonetheless reduced punitive damages to \$20 million from \$75 million, saying that while Monsanto “deserves to be punished” the higher award was “constitutionally impermissible” because it was nearly 15 times the compensatory damages award.

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"Monsanto's conduct, while reprehensible, does not warrant a ratio of that magnitude, particularly in the absence of evidence showing intentional concealment of a known or obvious safety risk," Chhabria wrote. Hardeman said he used Roundup for many years starting in the 1980s to treat poison oak and weeds on his property. He was diagnosed with non-Hodgkin's lymphoma in 2014, but is now in remission. Hardeman is one of more than 13,400 plaintiffs who have sued Bayer and Monsanto over Roundup, saying the herbicide's active ingredient, glyphosate, is unsafe. His case was considered a bellwether for hundreds of similar cases before Chhabria. In a statement, Bayer called Chhabria's decision "a step in the right direction," but said it still plans to appeal. Bayer said the verdict and damages award "conflict with both the weight of the extensive science that supports the safety of Roundup, and the conclusions of leading health regulators in the U.S. and around the world that glyphosate is not carcinogenic." Hardeman may appeal Chhabria's decision to reduce the damages award, which one of his lawyers, Michael Baum, in a statement called a "reversible error." U.S. Supreme Court precedents limit the ratio of punitive to compensatory damages to 9 to 1. "We are pleased that the judge denied Monsanto's motion to throw out the verdict, and recognised that Monsanto deserved to be punished," Jennifer Moore, a lawyer for Hardeman, said in an interview. "We disagree with any reduction in the jury verdict." Bayer paid \$63 billion for Monsanto.

Reuters Health, 16 July 2019

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

The sticky problem of plastic wrap

2019-07-18

Plastic wrap was discovered in a lab by accident in the 1940s. Now there are more than 100 brands of the covering to choose from. The slick, transparent film we now know as plastic wrap was originally a mistake of chemistry, a residue clinging stubbornly to the bottom of a beaker in a 1940s laboratory. The military originally used it to line boots and planes. Today, consumers around the world, and the grocery stores they shop in, have more than a hundred brands of the super water-resistant substance to choose from. Plastic wrap is popular in the United States. One industry research group found that, in the past six months, nearly 80 million Americans had used at least one roll of plastic wrap, but more than five million Americans had gone through more than 10 million boxes. Commercial uses in supermarkets and shipping account for the additional three million tons of plastic wrap companies expect to make in 2019.

It may save your sandwich, but plastic wrap pollutes the planet. Is there a better solution?

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Though the portable, cheap wrap keeps leftovers fresh for longer, there are several catches: Plastic wrap contributes to the larger plastic pollution crisis, it's difficult to recycle, and it's made from potentially harmful chemicals, especially as they break down in the environment. "If you look back to the 1950s when we didn't have as effective food storage like we do now, you can see why it was so popular," says Leah Bendell, a marine ecotoxicologist from Simon Fraser University. "We didn't have plastic 70 years ago, and then in the post-war boom, you had chemists who were going to provide us with this brave new world. Pesticides, herbicides, and plastics were a big part of that," she says.

Slick and green

When Ralph Wiley discovered polyvinylidene chloride (PVDC) while working in the physicals lab at Dow Chemical in Midland, Michigan, he nicknamed it eonite after a fictional, indestructible material in the comic strip "Little Orphan Annie." His task had been to create a new product out of hydrocarbon and chlorine, two by-products of manufacturing the dry-cleaning agent perchloroethylene. The newfound chemical was so water-resistant that it couldn't be washed clean from its distillation flask. PVDC molecules bind together so tightly, they're nearly impenetrable by oxygen and water molecules. Those properties made the material attractive in war efforts and in American kitchens as Saran Wrap. By the 1960s, the Australian company GLAD had created its own—though less clingy—version of plastic wrap from polyethylene. Saran Wrap too is now made from polyethylene after consumers grew concerned about the health impacts of wrapping their food in a plastic made with chloride. Today, consumers around the world have plastic wrap brands at their disposal made of PVDC, PVC, and polyethylene.

Plastic infiltrates the environment

Thin, flimsy, plastic-like bags are difficult to recycle; without specialized equipment they clog machines. And even when plastic wrap is recycled, it's costlier than using virgin materials. When it ends up in landfills or incinerators, both PVC and PVDC can release a highly toxic chemical called dioxin, says the World Health Organization. In marine environments, plastic wrap contributes to a larger plastic pollution crisis, but unlike other plastics, scientists are finding that PVC and PVDC do great jobs of picking up bacteria and metals. Those contaminated pieces of microplastic then harm the fish that mistake them for food. While environmental activists tend to advocate for ditching the product altogether, manufacturers point the finger at outdated infrastructure. Scott Defife, the vice president of

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government affairs at the Plastics Industry Association, says plastic films could be easily recycled if our infrastructure for collecting waste wasn't "lacking." "We want the federal government to make investments," he says. "They should think of it as a critical public utility like roads and bridges." The Plastics Industry Association touts plastic wrap as an effective way to reduce food waste by keeping food fresh. Discovered in 1933, the key chemical in plastic wrap was first used as a spray to protect fighter planes and other military gear from water. In 1949, Dow Chemical created the commercial plastic wrap we know today. "Each of these materials was developed for a reason," Defife says.

Concerns about safety

PVC and PVDC differ by the slightly different chloride compositions in each molecule. Saran Wrap includes some vinyl chloride, often 13 percent, and both typically have toxic additives, said Bendell. The Food and Drug Administration regulates both, permitting less than a fraction of one percent of PVC and PVDC food wrap from migrating into food. At that exposure level, it's highly unlikely someone could be poisoned by their plastic wrap. "If you have a dinner plate made out of PVC, is that posing a risk? Probably not," says Rolf Halden, an environmental scientist at Arizona State University's Biodesign Institute. "But if we surround ourselves with PVC and phthalates, they can leach or ooze out of the products. That creates an unwanted exposure." In order to make plastics softer, more flexible, and more transparent, they are often mixed with plasticisers, particularly for food packaging, says Ramani Narayan, a chemical engineer at Michigan State University. One common class of plasticizers is a group of molecules called phthalates—a category that contains carcinogens—although PVC plastic wrap doesn't contain them anymore. It does contain a plasticizer called DEHA, or diethylhexyl adipate, but its effects on human health are unclear. Stretch-Tite makes plastic wrap that contains PVC. In an email, they noted that their product is free of cancer-causing chemicals like BPA and phthalates, and they claim that safety concerns over plastic wrap aren't based in sound science. Says Halden: "Unlike infectious pathogens, the effects of toxic chemical exposures may take decades to manifest." And an increase in cancer rates, for example, would be challenging to tie directly to chemicals in plastic wrap.

The search for alternatives

Wax paper was frequently used in the decades before plastic wrap was stocked on supermarket shelves, and it's a reusable form of wax paper that's now offering an alternative to throwaway plastics. Bee's Wrap is

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made by coating bee's wax, jojoba oil, and tree resin onto a thin strip of cotton. Warmth from your hands loosens the bonds, making it more pliable and sticky. Co-owner of a start-up called Etee, Steve Reble says he was inspired by the ancient Egyptian wraps on mummies when he created his own version of a reusable food wrap by coating a thin strip of cotton in a waxy barrier. While still relatively new companies—Bee's Wrap was founded in 2012 and Etee in 2017—they've effectively captured a demographic of consumers searching for alternatives to single-use plastics. Reble says Etee food wraps have been able to eliminate more than 100 million square feet of plastic wrap in the past two years. Katie Flagg, a representative from Bee's Wrap, says the company grew by 87 percent last year. Consumer research group Nielsen estimates that U.S. consumers will spend \$150 billion on a wide variety of sustainable products by 2021. "We're becoming much more savvy about how we interact with our resources," says Flagg.

National Geographic, 12 July 2019

www.nationalgeographic.com.au

Vaping may aid smoking cessation but also boost relapse risk

2019-07-18

Adults who smoke cigarettes may have an easier time cutting back or quitting altogether if they start vaping, but a new French study also suggests that vaping may make ex-smokers more likely to relapse "Among adults, electronic cigarette use by never smokers is extremely rare - most users are smokers who want to quit or reduce their tobacco consumption or former smokers who want to prevent a relapse," said Ramchandrar Gomajee, lead author of the study and a researcher at Sorbonne University in Paris. Gomajee and colleagues followed 5,400 smokers for an average of 23 months, including 822 people who also reported daily use of e-cigarettes. Vapers smoked more traditional cigarettes a day - 11.2 compared with 9.8 on average. By the end of follow-up, however, vapers cut back more on daily cigarettes - eliminating 4.4 a day compared with 2.7 for non-vapers. And vapers were also 67% more likely to quit smoking. Separately, researchers also followed 2,025 former smokers for an average of 22 months, including 176 who reported regular e-cigarette use. Vapers were 70% more likely to resume smoking traditional cigarettes during the study than ex-smokers who had quit without vaping. "Former smokers who are using electronic cigarettes are still addicted to nicotine," Gomajee said by email. "In any situation where they suffer from withdrawal

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symptoms but are not able to use their electronic cigarette, for example because they have no e-liquid, or because of technical problems with the electronic cigarette, they are likely to smoke again." The study wasn't a controlled experiment designed to prove whether or how vaping might impact smoking habits for users of traditional cigarettes. And, the study also wasn't designed to test the safety or effectiveness of e-cigarettes as a smoking cessation aid. Another limitation is that researchers lacked data on the reasons people used e-cigarettes, making it impossible to determine whether smoking cessation or reduction of daily cigarette use was a goal of people who vaped, researchers note in *JAMA Internal Medicine*. Big U.S. tobacco companies are all developing e-cigarettes. The battery-powered gadgets feature a glowing tip and a heating element that turns liquid nicotine and flavourings into a cloud of vapor that users inhale. When e-cigarettes contain nicotine, they can be addictive like traditional cigarettes. Even without nicotine, earlier research suggests that flavourings and other ingredients in e-liquids used for vaping could be linked to serious breathing problems. A big question about e-cigarettes, namely, whether they're safe or at least safer than traditional cigarettes, isn't answered by the current study. "E-cigarettes do not have the same level of known carcinogens as cigarettes, so they are safer in this respect," said Thomas Wills, a researcher at the University of Hawaii Cancer Centre in Honolulu who wasn't involved in the study. "However, in the last three years a lot has come out on other side effects," Wills said by email. "There are now 15 studies showing a linkage of e-cigarette use to respiratory disease (asthma and COPD) in both adolescence and adulthood ... so it's difficult to argue seriously that e-cigarettes are safe from a health standpoint." Smokers who want to quit should try other cessation aids like nicotine replacement patches or Chantix, a prescription smoking cessation drug, before attempting to quit aided by e-cigarettes, Wills advised. While some people do achieve long-term cessation with the help of e-cigarettes, this is a small fraction of smokers, said Stanton Glantz, director of the Centre for Tobacco Control Research and Education at the University of California San Francisco. "E-cigarettes should not be recommended for smoking cessation," Glantz, who wasn't involved in the study, said by email. "Dual use is more dangerous than smoking alone, which is an important and under-appreciated effect."

Reuters Health, 16 July 2019

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

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J&J faces U.S. criminal probe related to baby powder - Bloomberg

2019-07-18

The United States Justice Department is pursuing a criminal probe into whether Johnson & Johnson lied about potential cancer risks of its talcum powder and has convened a grand jury in Washington, Bloomberg reported, citing people with knowledge of the matter. The Bloomberg report said the grand jury was looking into documents related to what company officials knew about any carcinogens in their products. J&J disclosed in its annual report in February that it had received subpoenas from the Justice Department and Securities and Exchange Commission related to the ongoing baby powder litigation but did not give more details. The company said in a statement emailed to Reuters that there had been no new developments in the matter. "As we previously disclosed in our February 2019 SEC filing, we have received a subpoena from the U.S. Department of Justice. We are fully cooperating with the DOJ investigation," spokesman Ernie Knewitz said in an emailed statement. The Justice Department declined to comment. Shares of the company fell 5% to \$133.02 following the report. Johnson & Johnson faces lawsuits involving over 14,000 plaintiffs who allege use of its talc products, including Baby Powder, caused cancer. A Reuters report on 14 December revealed that Johnson & Johnson knew for decades that small amounts of asbestos, a known carcinogen, had been occasionally found in its talc and powder products, according to tests from the 1970s to the early 2000s - information it did not disclose to regulators or the public.

Reuters Health, 13 July 2019

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

Dementia: Lifestyle changes that could lower your risk

2019-07-18

Nearly everyone can lower their risk of dementia, even if it runs in the family, by living a healthy lifestyle, research suggests. The study of nearly 200,000 people showed the risk fell by up to a third. The team at the University of Exeter said the results were exciting, empowering and showed people were not doomed to get dementia. The findings were revealed at the Alzheimer's Association International Conference.

What counts as a healthy lifestyle?

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The researchers gave people a healthy lifestyle score based on a combination of exercise, diet, alcohol and smoking.

This is an example of someone who scored well:

- Doesn't currently smoke
- Cycles at normal pace for two-and-a-half hours a week
- Eats a balanced diet that includes more than three portions of fruit and vegetables a day, eats fish twice a week and rarely eats processed meat
- Drinks up to one pint of beer a day

And an unhealthy one?

- Currently smokes regularly
- Does no regular exercise
- Eats a diet that includes less than three servings of fruit and vegetables a week, and includes two or more servings of processed meat and of red meat a week
- Drinks at least three pints of beer a day

How easy is it to do?

Sue Taylor, 62, from Exeter, has seen the impact of dementia on a family - both her mother and grandmother had the disease. She takes exercise classes in the park three times a week - even in winter - and has a 45-minute walk before work. "It takes a lot of effort, you have to think about it and make it fit in," she told me. But she says it's worth it, especially for her grandchildren. "I just want to keep my brain as sharp as possible for as long as possible. I don't want them to miss out on having grandparents both physically and mentally," she said.

So how big a difference did lifestyle make?

The study followed 196,383 people from the age of 64 for about eight years. It analysed people's DNA to assess their genetic risk of developing the disease. The study showed there were 18 cases of dementia per 1,000 people if they were born with high risk genes and then led an unhealthy lifestyle. But that went down to 11 per 1,000 people during the study if those high-risk people had a healthy lifestyle.

It doesn't seem like a big difference?

The figures might seem small, but that is because your mid-60s are relatively young in terms of dementia. The researchers say cutting dementia rates by a third would have a profound impact in older age

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groups where the disease is more common. "It could equate to hundreds of thousands of people," Dr David Llewellyn, told the BBC. Also, this type of research cannot definitively prove that lifestyle causes different risks of dementia. It simply spots patterns in the data. But the results, published in the Journal of the American Medical Association, fit with previous research and World Health Organization advice.

Can I dodge dementia completely?

Sadly, you can live the life of a saint and still get the disease. Lifestyle just changes the odds. However, there are still no drugs to change the course of this disease. Reducing your chances is all anyone can do.

Does this apply to everybody?

The findings may not apply to people with very early onset dementia that starts when people are in the 40s and 50s, say the researchers. But they think their results would apply to people in older age groups when dementia gets more common. The researchers say the study applies to dementia in general rather than specific forms of the disease like Alzheimer's or vascular dementia.

What is the key message?

"Even if you're worried about dementia, maybe you've got a family history yourself, what our research suggests is it doesn't matter, Dr David Llewellyn, told the BBC. "You're still likely to lower your own risk of dementia substantially if you change to a healthy lifestyle." That's really empowering." Fellow researcher Dr Elzbieta Kuzma said it was the first time anyone had shown you could counteract an inherited risk of dementia and the findings were "exciting".

What do the experts say?

Fiona Carragher, from the Alzheimer's Society, commented: "With one person developing dementia every three minutes in the UK, knowing how to lower our dementia risk couldn't be more vital. "So hit that salad bar, swap a cocktail for a mocktail and get your exercise kit on!" Dr Carol Routledge, from Alzheimer's Research UK, said the findings were "important". "This is yet more evidence that there are things we can all do to reduce our risk of developing dementia, yet research suggests that only 34% of adults think that this is possible. "While we can't change the genes

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we inherit, this research shows that changing our lifestyle can still help to stack the odds in our favour.”

BBC News, 14 July 2019

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

Recycled electronics are turning Thailand into a ‘dumping ground for hazardous waste’

2019-07-18

Global waste markets were upended in 2018 when China implemented tough new import restrictions on plastic and e-waste materials from foreign nations, forcing countries to find new markets. Australia is among the countries taking advantage of the lax environmental regulations in Asia, redirecting trash China will no longer take to countries like Thailand, Malaysia and Indonesia. But the rapid shift in global markets has had a devastating flow-on effect to communities now dealing with a flood of contaminated waste. In Thailand, scores of new sorting and recycling companies — many of them illegal and with Chinese shareholders — have sprung up in provinces surrounding the country’s main port of Laem Chabang. The agricultural district of Chachoengsao, east of Bangkok, is one of the provinces which became a dumping ground for e-waste. Local villager Payao Charoonwong said she has lost her main water source as a result. “I have been using water in this well for 20 years for cooking, boiling and drinking. But the condition of the water in the well is not usable anymore,” Ms Charoonwong said. Her once peaceful property amid vast cassava fields was transformed in late 2017, when a nearby Chinese-run factory started bringing in truckloads of foreign e-waste items such as crushed computers, circuit boards and cables. It is a lucrative business for recyclers who mine the electronics for valuable metal components like copper, silver and gold. But the items also contain lead, cadmium and mercury, which are highly toxic if mishandled during processing. Apart from feeling faint from noxious fumes emitted during processing, Ms Charoonwong claimed the factory has also contaminated her water.

“When it was raining, the water went through the pile of waste and passed our house and went into the soil and water system.” “The water started to change from clear water to orange colour. There was a bad smell — very bad — and there are toxic chemicals,” she said. Ms Charoonwong said their once bountiful cassava harvests were now rotting. Water tests conducted in the province by environmental group Earth and the local government both found toxic levels of iron, manganese, lead, nickel and in some cases

Environmental activists say there are many illegal e-waste processing facilities in Thailand

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arsenic and cadmium. "The communities observed when they used water from the shallow well, there was some development of skin disease or there are foul smells," founder of Earth, Penchom Saetang said. "This is proof, that it is true, as the communities suspected, there are problems happening to their water sources."

Australia among e-waste offenders in Thailand

Police raided the factory and found the Chinese firm had no licence to operate and was illegally processing foreign waste. It was ordered to shut down, but locals claim trucks are continuing to deliver electronics there. This is just a fraction of the e-waste flowing in to the country, with Thailand's weak environmental laws making it easy for traders to breach the border. "It is obvious that e-waste is being imported into Thailand rapidly and in huge amounts, making Thailand the dumping ground for hazardous waste," Ms Saetang said. "We have collected the top 10 [nations] exporting e-waste into Thailand which include China, the USA, the UK, Japan, Korea, Singapore and Australia, who are exporting a huge amount of e-waste to Thailand." Thai Customs data shows Australia sent more than 250,000 kilograms of electronic scraps, battery parts and machinery to Thailand last year — 500 times the amount shipped in 2017. But this is just one category of e-waste coming in. There are many others which are less regulated and more difficult to monitor. The jump in imports from the west and parts of North Asia is fuelling a boom in Chinese scrap processing facilities, which are relocating their businesses to continue cashing on the lucrative trade. "We found that it seems like an underground network of illegal practice of Chinese factories or businesses," Ms Saetang said. Investigations by a team of environmental scientists and engineers at Earth uncovered illegal activities by Chinese firms, which have led to a number of high-profile police raids in recent months. "There are increasing numbers of Chinese factories located in these provinces of Thailand, operating recycling of plastic, e-waste and certain types of hazardous waste," she said. South-East Asian nations fed up with becoming the world's dumping ground are now pushing back against the rising flood of imports. Indonesia last week declared it would send eight shipping containers of paper back to Australia after it found household garbage including nappies and electronics inside. The containers were deemed contaminated by toxic or hazardous materials. Malaysia and the Philippines have also started sending unwanted trash back to its source while others, like Thailand, are vowing to strengthen their environmental laws. As developing nations revolt, pressure is mounting on countries like Australia to develop an onshore processing industry for coping with the

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global shift in waste markets. In a statement, the Australian Government said it had not received any reports of improper exports to Thailand but was committed to stamping out bad behaviour, if companies were found to be violating Australian law.

ABC News, 16 July 2019

<http://www.abc.net.au/news/>

Researchers describe new ALS biomarkers, potential new drug targets

2019-07-18

Amyotrophic lateral sclerosis, or ALS, is an adult-onset neurodegenerative disease that causes paralysis and ultimately death when the nerves enervating the lungs cease to carry the signals needed for breathing. The disease has what is called a "focal onset," where paralysis starts with an arm or a leg and spreads throughout the body as motor neurons in the spinal cord and brain die off. Early diagnosis of the disease has not been possible because of a lack of known biomarkers indicative of ALS, but scientists believe that cellular changes within spinal neurons occur before symptoms are detectable, and these changes could serve as useful biomarkers that can aid in earlier diagnosis. Now, researchers at the University of Illinois at Chicago have described unique populations of neurons and associated cells in the spinal cords of patients who died of ALS. When symptoms of ALS begin with the paralysis of an arm or a leg, it means that the disease has affected the motor neurons that enervate that arm or leg and which originate in a specific region along the spinal cord. For example, neurons that innervate the arm originate in the upper part of the spinal cord. In ALS, where symptoms first appear in the arm, the motor neurons in the upper spine region die off. Motor neurons above and below that region begin to die off next as the disease spreads up and down the spine, causing paralysis of other parts of the body. The researchers, led by Fei Song, associate professor of neurology and rehabilitation in the UIC College of Medicine, found that patients with focal-onset ALS had different types of neurons in areas of the spinal cord that are less affected by the disease compared with patients without neurological disorders. They also found that spinal neurons in less affected regions of patients who died of focal-onset ALS were associated with cells called microglia and astrocytes. They report their findings in the journal *Neurobiology of Disease*. "Since there must be cellular changes occurring in spinal cord regions adjacent to areas where the disease has clearly affected motor neurons in the spine, we wanted to look at neurons from these adjacent areas to determine

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if they are different from healthy tissue,” Song said. “The debilitating disease has no effective treatment to stop the disease progression and there are only two medications that can prolong patient survival by a few months. So, new drug targets, especially ones that could be given in the earlier stages of the disease, are very much needed.” Song had worked with Dr. John Ravits, professor of clinical neurosciences at the University of California, San Diego, on ALS research in the past. Ravits sees patients with ALS and runs a biorepository that includes nerve tissue from patients who died of ALS and consented to have their nerve tissue collected after death. Ravits published a paper in 2010 analysing the expression of genes in spinal motor neurons taken from 12 patients whose ALS started focally compared with nerves of patients without neurological disorders. Motor neurons were collected from less affected regions of the spinal cord where the tissue was assumed to be in the earlier stages of disease. While significant differences were found, Song wanted to reanalyse the genetic data using a new technique that could shed light on different cell types that may have been present in the samples collected by Ravits. Song and colleague Fabien Dacht, a research specialist with bioinformatics expertise in the UIC department of neurology and rehabilitation, applied a novel bioinformatics analysis to the genetic data. “When we examined the data, it was clear that the mixture of cells from the ALS patients was very different from patients with no neurodegenerative disease,” Song said. They found that in samples from patients with focal-onset ALS, there were different types of motor neurons compared with control samples from patients without neurological disease. They also saw other cells called microglia and infiltrated macrophages associated with motor neurons from the ALS patients, where these cells were absent in similar samples from patients without neurological disease. “We found a novel and unique subtype of motor neurons in these patients never before reported,” Song said. “Now that we have identified new subtypes of motor neurons and microglia present in ALS patients, we can begin to further study their roles in contributing to disease progression.”

Medical Xpress, 15 July 2019

<http://medicalxpress.com>

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