

## Contents

**CHEMWATCH**

(click on page numbers for links)

### REGULATORY UPDATE

#### ASIA PACIFIC

Workplace exposure standards open for public comment.....	4
Senate estimates February 2019 opening address—Dr Chris Parker .....	4
Scheduled excipients in agricultural chemical formulations .....	6
New material released for public submission of Exirel Insecticide .....	7
China consults on the List of Toxic and Hazardous Water Pollutants .....	8

#### AMERICA

EPA Releases First Major Update to Chemicals List in 40 Years.....	9
Antimony trade group raises concerns over proposed threshold limit .....	10
Florida city bans sunscreens with chemicals thought to harm coral .....	12
California SCP programme confirms flame retardant phase-out .....	13

#### EUROPE

UK, Finland dissent led to withdrawal of PFHxA SVHC proposal .....	14
The New EU Single-use Plastics Directive EU to Adopt Law on the Reduction of the Impact of Certain Plastic Products on the Environment	15
Germany AwSV List of published WGK classifications updated .....	25

### REACH UPDATE

High-volume plastic additives mapped.....	27
REACH 2018 registration data now included in QSAR Toolbox.....	28
REACH compliance – an Agency priority for 2019 .....	29
List of biocides suppliers updated .....	32
Updated list of intentions to renew active substance approval .....	32

### JANET'S CORNER

Decrease in Concentration .....	33
---------------------------------	----

### HAZARD ALERT

Tungsten.....	34
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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.**

## Contents

**CHEMWATCH**

### GOSSIP

PFAS and phthalate chemical exposure early in life may hamper kids' lungs.....	39
Scientists Invent a Flexible Device That Converts Wi-Fi Signals Into Electricity.....	40
How diapers and menstrual pads are exposing babies and women to hormone-disrupting, toxic chemicals .....	41
New analysis raises questions about EPA's classification on glyphosate weed killer .....	44
Scientists Just Defied Chemistry Basics by Flipping 'Left-Handed' Molecules With Light .....	46
'Inkjet' solar panels poised to revolutionise green energy.....	47
Invisible tags: Physicists write, read and erase using light .....	49
3D printed tires and shoes that self-repair.....	50
Ferroelectric polymers made more versatile.....	52
Researchers use artificial neural networks to streamline materials testing.....	53
Building self-tests for the world's most common infectious diseases—with paper .....	54
Observing hydrogen's effects in metal.....	56
Rust never sleeps.....	58
Lettuce show you how to restore oil-soaked soil .....	59
Researchers synthesise renewable oils for use in lubricants .....	61
Simply shining light on dinosaur metal compound kills cancer cells.....	62
Research shows hidden fire risk of emollients.....	63

### CURIOSITIES

Fish oil does not appear to improve asthma control in teens, young adults .....	66
Yes please to yogurt and cheese: The new improved Mediterranean diet.....	67
New study offers 'strongest evidence' yet that exercise helps prevent depression.....	68
Not All Insomnia Is The Same — In Fact, There May Be 5 Types.....	70
Increasing temperatures from climate change may harm babies' hearts .....	73
Desalination plants are on the rise—so is their salty, chemical waste .....	74
Here's The Simple Way to Lose Weight And Keep It Off, According to Science .....	75

## Contents

**CHEMWATCH**

Disturbing Video Footage Reveals How Tasers Can Actually Set a Person on Fire .....	77
A toxic-chemicals expert is sounding the alarm about 4 cancer-linked chemicals that could be making us sicker and fatter .....	78
Butter-Scented Chemical Linked to "Popcorn Lung" Discovered in Vape Juices .....	82
Nanoparticles may promote cancer metastasis.....	83
Female Brains Appear to Be More Youthful Than Male Ones, Study Suggests .....	85
Marijuana smoking linked with higher sperm concentrations, study finds.....	86
Study reveals how immune cells target different tissues .....	88
Teen e-cigarette use linked to eventual smoking .....	89
Vitamin or Mineral Supplements Don't Prevent Dementia.....	91
Scientists identify reversible molecular defect underlying rheumatoid arthritis .....	92

### TECHNICAL NOTES

(Note: Open your Web Browser and click on Heading to link to section)...	95
ENVIRONMENTAL RESEARCH .....	95
MEDICAL RESEARCH.....	95
OCCUPATIONAL RESEARCH .....	95
PUBLIC HEALTH RESEARCH.....	96

## Regulatory Update

CHEMWATCH

### ASIA PACIFIC

#### Workplace exposure standards open for public comment

2019-02-21

Safe Work Australia is currently evaluating the *Workplace exposure standards for airborne contaminants* to ensure they are based on the highest quality evidence and supported by a rigorous scientific approach. The agency will be seeking public comment on the draft evaluation reports and recommendations for the workplace exposure standards (WES) throughout 2019, beginning with respirable crystalline silica and respirable coal dust. In particular, we are seeking comments of a technical nature regarding:

- the toxicological information and data that the value is based upon, and
- the measurement and analysis information provided.

Access our consultation platform Engage to provide your comments on the draft evaluation reports and recommendations for respirable crystalline silica and respirable coal dust before 30 April 2019. The feedback that is received as part of this process will be considered when making final recommendations regarding the workplace exposure standards. The draft evaluation reports and recommendations for the remaining chemicals on the *Workplace exposure standards for airborne contaminants*, as well as additional chemicals that are being considered for inclusion on this list, will be released throughout 2019. If you know someone who has an interest in workplace exposure standards, please forward this email and recommend they subscribe to receive updates (be sure to check the 'Chemical exposure standards' box)

Safe Work Australia, 18 February 2019

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

#### Senate estimates February 2019 opening address—Dr Chris Parker

2019-02-21

In 2018, the Australian Pesticides and Veterinary Medicines Authority (APVMA) finalised around 3,500 applications for chemical actives, products, and permits. Each of these is a product in the hands of crop producers, pest controllers, gardeners, veterinarians and graziers. This

**Safe Work Australia are calling for comments on the recommended values for respirable crystalline silica and respirable coal dust.**

## Regulatory Update

### CHEMWATCH

work hinges on making science-based decisions to ensure agvet chemical products are safe for the community and environment, and effective for users. One of my key focuses has been on improving the APVMA's ability to meet legislative timeframes. Since late 2017, the agency has had five quarters of improved performance, and we remain focused on keeping performance at a sustainable level as we manage the last stages of the relocation. APVMA look for efficiencies where they can, and one avenue is the use of assessments from trusted international regulators. In the 2017–18 financial year, international assessments contributed to 34 component evaluations across chemistry, efficacy, environment, health and residue risk areas, up from 15 component evaluations the previous year. To get the best out of our people, APVMA have been investing in resources to assist them in their vital work. Steady progress has been made in implementing the objectives of the Digital Strategy. Major elements of this strategy have been settled through our Enabling Technology program. In September 2018, the contract for digitisation of the APVMA's 177,000 analogue and paper-based records was signed. By the end of January, over 17,000 paper files had been scanned, and automated loading of digital files to APVMA's records management system is now occurring. In December 2018, the contract for cloud-hosted infrastructure and ICT managed services was signed. The vendor is already on-site and working to transition our IT infrastructure into the cloud before operations from APVMA's new office in Armidale commences. Transition to a cloud-hosted environment will allow the APVMA to improve our workflow and resource management functions. Furthermore, in December, our contract for the APVMA's electronic document and records management system was renewed. The new contract ensures that the agency will continue our transformation to a fully digitally enabled regulator by 2020. APVMA's permanent Armidale office is drawing closer to completion. Work remains on schedule for us to occupy the building by mid-2019. The structure is finished, windows have been installed, and work has begun on the interior.

Planning the phased transition of staff into the office has now begun. Recruitment activities have continued at pace. There has been a focus from some quarters on what the APVMA has lost in terms of staff and experience and this is undeniable. However, at previous estimates, the move has provided APVMA with opportunities for renewal of the business. Some highly experienced and energetic individuals have also been gained. At January 31st, there were 72 staff in Armidale, and a further 18 staff will commence by the end of March. By the end of March, there will be 39 regulatory scientists in Armidale. The Australian public and industry expect us to make science-based decisions for the good of

## Regulatory Update

### CHEMWATCH

the community and agricultural productivity. With a mix of around 40 experienced scientists and decision-makers in the Canberra satellite office and APVMA's qualified scientists in Armidale, there is every confidence that the agency will continue to get the job done. Since last Estimates, APVMA have reorganised the operating model to better align with post-market activities. The Chemical Review, Adverse Experience Reporting, Manufacturing Quality and Licencing, and Compliance and Monitoring functions have been combined under the new Chief Regulatory Scientist to allow a more holistic approach to post-market activities. APVMA is also investing significantly in developing the regulatory knowledge of all staff. The Chief Regulatory Scientist is delivering a comprehensive learning and development program focused on knowledge management and reinforcing a culture of quality across the organisation. The agency is now at the stage in their operational planning where it needs to have an eye to a financially sustainable future. As you're aware, APVMA are primarily a cost-recovered agency, through the collection of industry fees and levies, and work has begun on a new Cost Recovery Implementation Statement, or CRIS. As part of the CRIS, and for the first time, the APVMA is logging effort across our work areas and getting a clear understanding of the resources required to do the work. This work is just so important for us to set the organisation up with a sound financial footing for the coming years whilst ensuring we have the resources to fully meet the expectations of the Australian community. APVMA expect the first consultations with stakeholders to take place next month.

APVMA, 19 February 2019

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

### Scheduled excipients in agricultural chemical formulations

2019-02-21

Agricultural chemicals can contain other ingredients in addition to the active constituents. These non-active constituents or excipients generally are not required to be included on the product label, unless they are scheduled poisons according to the current Poisons Standard. The Agvet Code, Agvet Regulations and Agricultural Labelling Code require that the label of an agricultural chemical product must include the name and proportion of any constituent contained in the formulation that is a scheduled poison. The appropriate signal heading (for example, CAUTION or POISON) must also be displayed on the label. Common excipients in

**Excipients generally are not required to be included on the product label, unless they are scheduled poisons according to the current Poisons Standard.**

## Regulatory Update

**CHEMWATCH**

agricultural chemical products that are scheduled poisons and required to be on the label (at various concentrations) include:

- ethylene glycol
- diethylene glycol
- diethylene glycol monobutyl ether
- n-methyl-2-pyrrolidone
- polyethoxy (15) tallow amine (also called tallow amine ethoxylate)

Please check the Poisons Standard for all scheduled chemicals. Some of these common scheduled excipients will also require additional first aid and safety directions as required by the First Aid and Safety Directions (FAISD) handbook. It is a holder's responsibility to ensure their product labels comply with the relevant legislation including the Agvet Code, Agricultural Labelling Code, the Poisons Standard and the FAISD Handbook. When submitting an application to register an agricultural chemical product, please ensure that any scheduled excipients in the formulation are included on the proposed label. If you are the holder of a product that contains a scheduled excipient that is not on the approved product label, you are required to submit a variation application to the APVMA to update your label.

APVMA Regulatory Update, 24 February 2019

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

### **New material released for public submission of Exirel Insecticide**

2019-02-21

Information not previously available to those who made submissions on the reassessment of Exirel Insecticide is now being made public. FMC New Zealand Ltd, manufacturer and importer of Exirel, is proposing that the current restrictions for ground-based use are eased to also allow the spraying of brassicas from helicopters, which is currently not allowed. NZ EPA are now releasing the letters of support for further comments by those people and organisations that were parties at the public hearing in December 2018.

#### Why this information was not previously available

A public hearing was held on Wednesday 12 December 2018 for a Decision-making Committee to hear the proposals, submitters' viewpoints, and our evaluation. Prior to the hearing a submitter (Apiculture New

**Information not previously available to those who made submissions on the reassessment of Exirel Insecticide is now being made public.**

## Regulatory Update

### CHEMWATCH

Zealand) sought access to letters of support to the application that the applicant had asked to be treated as confidential. The hearing was adjourned to allow this request, and the reasons provided for the letters to be confidential, to be considered.

Letters of support for the proposed changes have now been reclassified as not confidential.

#### Additional submission period open

New comments on this newly released information, from people and organisations that were parties at the public hearing in December 2018, are required by the 5pm on 26 February 2019. The adjourned hearing will close after this additional submission period and any new comments will be considered by the Decision-making Committee.

Further information is available at:

- [Minute from the Chair of the Decision-making Committee \(pdf 304KB\)](#)
- [Read Apiculture New Zealand's Point of Order \(pdf 472 KB\)](#)
- [Letters of support](#)

NZ EPA, 13 February 2019

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

### China consults on the List of Toxic and Hazardous Water Pollutants

2019-02-21

On 25 January 2019, China's MEE opened public consultation on the *draft list of toxic and hazardous water pollutants (First Batch)*. The public consultation period will end on 16 February 2019.

The first batch in the draft list contains 9 water pollutants:

No.	Pollutants
1	Dichloromethane
2	Tri-chloromethane
3	Tri-chloroethylene
4	Tetra-chloroethylene
5	Cadmium and its compounds
6	Mercury and its compounds
7	Chromium VI and its compounds

**On 25 January 2019, China's MEE opened public consultation on the draft list of toxic and hazardous water pollutants (First Batch). The public consultation period will end on 16 February 2019.**

## Regulatory Update

### CHEMWATCH

No.	Pollutants
8	Lead compounds
9	Arsenic and its compounds

This is the first batch released since the implementation of the *Water Pollution Prevention Law*. According to the provisions in the *water pollution prevention law*, entities discharging pollutants shall implement risk management, including self-monitoring of emissions, data storage, pollutants information disclosure and practical environmental risk prevention. Any violation of risk management requirements will result in a fine of between 20,000RMB to 200,000RMB. Further information is available at: [MEE News](#)

Chemlinked, 14 February 2019

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

## AMERICA

### EPA Releases First Major Update to Chemicals List in 40 Years

2019-02-21

Recently, the United States Environmental Protection Agency (EPA) released an update of the Toxic Substances Control Act (TSCA) Inventory listing the chemicals that are actively being manufactured, processed and imported in the United States. A key result of the update is that less than half of the total number of chemicals on the current TSCA Inventory (47 percent or 40,655 of the 86,228 chemicals) are currently in commerce. As the result of a tremendous effort on behalf of thousands of stakeholders and manufacturers from across the country, this information will help EPA focus risk evaluation efforts on chemicals that are still on the market. "It's important for us to know which chemicals are actually in use today. This will help us with our work prioritizing chemicals, evaluating and addressing risks. This information also increases transparency to the public," said Office of Chemical Safety and Pollution Prevention Assistant Administrator Alexandra Dapolito Dunn. As recently as 2018, the TSCA Inventory showed over 86,000 chemicals available for commercial production and use in the U.S. Until this update, it was not known which of these chemicals on the TSCA Inventory were actually in commerce. Under amended TSCA – The Frank R. Lautenberg Chemical Safety for

**Recently, the United States Environmental Protection Agency (EPA) released an update of the Toxic Substances Control Act (TSCA) Inventory listing the chemicals that are actively being manufactured, processed and imported in the United States.**

## Regulatory Update

### CHEMWATCH

the 21 Century Act – EPA was required to update the list and designate which chemicals are active or inactive in U.S. commerce. More than 80 percent (32,898) of the chemicals in commerce have identities that are not Confidential Business Information (CBI), increasing public access to additional information about them. For the less than 20 percent of the chemicals in commerce that have confidential identities, EPA is developing a rule outlining how the Agency will review and substantiate all CBI claims seeking to protect the specific chemical identities of substances on the confidential portion of the TSCA Inventory. From 11 August 2017 through 5 October 2018, chemical manufacturers and processors provided information on which chemicals were manufactured, imported or processed in the U.S. over the past ten years, the period ending 21 June 2016. The agency received more than 90,000 responses, which represents a significant reporting effort by manufacturers, importers and processors. To download the public version of the initial TSCA Inventory, get more information about the TSCA Inventory Notification (Active-Inactive) Requirements rule, or requirements to notify EPA going forward: <http://www.epa.gov/tsca-inventory>.

U.S EPA, 19 February 2019

<http://www.epa.gov>

### Antimony trade group raises concerns over proposed threshold limit

2019-02-21

The International Antimony Association (i2a) has said a recent proposal to lower the threshold limit value (TLV) for the substance antimony trioxide would cause production challenges and increased costs for many users. Antimony substances are used extensively in flame retardants and also in lead batteries, alloys, plastics, paints, glass and other ceramics. Earlier this month, US scientific organisation the Association Advancing Occupational and Environmental Health (ACGIH), recommended that the threshold limit for inhaling antimony trioxide should be 0.02mg/m<sup>3</sup>. The ACGIH's recommended limit has been 0.5mg/m<sup>3</sup> since 1979. If the updated proposal is adopted, many users of the substance would face problems across their production processes, as well as higher costs, says i2a secretary general Caroline Braibant. While the ACGIH is not a regulatory agency, its opinions and conclusions on substances are well respected and can influence regulatory decisions. To achieve such a limit, users of antimony trioxide would need to use low-dust or dust-free forms of the substance, such as wetted powders or masterbatches, which is where antimony is

**Users would see increased costs and process issues**

## Regulatory Update

### CHEMWATCH

already added to a polymer, for example. "Half of the production volume of antimony trioxide in the EU has already moved to these supply forms. But the cost of these forms to users is slightly higher because of the extra processing involved," says Ms Braibant. In addition, implementing the relevant workplace controls to comply with the threshold limit value may actually require significant, and much larger, investments, she adds. The dust-free form of antimony, she says, is however "sometimes perceived as not as compatible with some downstream production processes". Solutions to this issue can be established through better user and producer communication, says Ms Braibant. "Users can discuss the process barriers with their producers, explain their process needs and the producers may then be able to adjust." But some users are not open to sharing their process details for confidentiality reasons. "Therefore, they prefer to buy the pure powder form, despite the higher exposure potential it entails" she says.

#### 'Little detail'

In 2017, following the release of the US National Toxicology Program (NTP) Carcinogenicity studies on antimony trioxide, the ACGIH proposed a respirable limit of  $0.03\text{mg}/\text{m}^3$ . But the ACGIH withdrew the proposal after it held a public consultation. ACGIH calculated its new proposed value for inhalable exposure by transforming the lowest concentration of respirable antimony – where the NTP studies' mice and rats developed adverse chronic lung effects ( $3\text{mg Sb}/\text{m}^3$ ) – into a human equivalent concentration. It then divided it by a number of "uncertainty factors". "This calculation mostly boils down to interpreting the very recent NTP toxicological animal evidence against the very limited reliable and relevant workplace exposure information available," an i2a press release says. "However, very little detail is provided regarding the fashion in which respirable aerosol impacts in the NTP studies were converted to a proposed inhalable limit or the uncertainty factors that were applied in ACGIH's derivation of the proposed TLV," it adds. The difference between respirable and inhalable is that the former measures the particles that reach and enter the deep lung, while inhalable measures where they enter the nose and mouth. In addition to submitting comments on the proposal, i2a plans to inform the ACGIH about its workplace monitoring program, which kicks off next week. "The data collected through this programme should replace a number of old, incomplete and unreliable workplace monitoring data ACGIH is currently referring to," the press release says. The deadline for

## Regulatory Update

### CHEMWATCH

commenting on the ACGIH's proposal is 31 May. Further information is available at: [i2a press release](#)

Chemical Watch, 15 February 2019

<http://chemicalwatch.com>

### Florida city bans sunscreens with chemicals thought to harm coral

2019-02-21

The city of Key West, Florida has banned sunscreens containing oxybenzone and octinoxate, following the lead of Hawaii, which introduced the world's first ban on these ingredients in July 2018. The city's commissioners expressed concern about evidence showing that oxybenzone and octinoxate damage coral reefs, and they approved the motion on 5 February with a vote of 6–1. The only coral reef in North America sits just a few miles off the Florida Keys. 'To me it boils right down to the fact that there are thousands of sunscreens out there and we have one reef, and we have an opportunity to do one small thing to protect that,' Key West mayor Teri Johnston said. 'I believe it's our obligation.' The ban will go into effect on 1 January 2021 – the same day that the Hawaii ban is set to come into force – and it will reportedly be enforced via warnings and civil citations. However, exceptions will be allowed for medically licenced prescriptions. The one dissenter on the Key West City Commission was Greg Davila, who argued that there exists 'scientific ambiguity' about the environmental harm caused by the two sunscreen ingredients in question. He also said that it would be preferable if Hawaii had to fend off any legal challenges that might result from its ban first, rather than Key West. 'I would much rather let Hawaii deal with that expense,' Davila said. Concerns about oxybenzone and octinoxate in sunscreens go beyond the US. In October, the tiny Pacific island nation of Palau became the first country to ban the sale of sunblocks that contain any one of 10 chemicals considered 'reef toxic', including oxybenzone and octinoxate. That ban will come in at the start of 2020.

Chemistry World, 12 February 2019

<https://www.chemistryworld.com>

**The city of Key West, Florida has banned sunscreens containing oxybenzone and octinoxate, following the lead of Hawaii, which introduced the world's first ban on these ingredients in July 2018.**

## Regulatory Update

**CHEMWATCH**

### California SCP programme confirms flame retardant phase-out

2019-02-21

Testing by California's Department of Toxic Substances Control has confirmed that children's sleep products sold in the state "appear to be in compliance" with its Safer Consumer Products (SCP) regulations. California designated children's foam-padded sleeping products containing the flame retardants TDCPP and TCEP as its first 'priority product' under the SCP program, effective in July 2017. And under the state's regulations, manufacturers had either to stop using the targeted chemicals, or to begin an analysis to determine if safer alternatives exist. The agency received no notifications from manufacturers indicating they were planning to conduct such an analysis by the September 2017 deadline. The state therefore began carrying out compliance checks to ensure that the covered products were free from those substances. In a report released recently, *Testing Children's Foam-Padded Sleeping Products in California: A Summary of Findings*, the DTSC confirmed that none of the 21 products it tested contained TDCPP or TCEP at levels that indicated they were intentionally added. Based on these findings, it said it believes the substances are being phased out of these products and that no further compliance activities are warranted at this time.

#### Further findings

The report indicated that, despite finding no significant levels of TDCPP or TCEP in any of the products it tested, other common flame retardants that the regulations do not cover did appear in products at levels near or above 1,000 parts per million (ppm). This included:

- the 'Firemaster' compound in a bassinet (1,160ppm) and a resting mat (57,852ppm);
- a mixture of TCEP, TCPP and TDCPP in a foam pillow (914ppm); and
- TCIPP in a cot (41,910ppm).

The testing further identified a product marked as meeting CertiPUR-US certification – an industry standard that certifies products have been tested and shown to be free of certain chemicals – which contained flame retardants not permitted under the scheme. The DTSC also noted that testing revealed some manufacturers are using recycled foam in children's products, which "may increase the probability that products may contain unknown flame retardants at high concentrations". But the report said that the products with high flame retardants were manufactured in 2013-

**Testing by California's Department of Toxic Substances Control has confirmed that children's sleep products sold in the state "appear to be in compliance" with its Safer Consumer Products (SCP) regulations.**

## Regulatory Update

### CHEMWATCH

15, or had no manufacture date. And since none of those manufactured within the last two years contained flame retardants, “we believe this may indicate manufacturers have started phasing out or have ceased adding flame retardants to these types of children’s products,” it said. “Before DTSC listed children’s foam-padded sleeping products as a priority product, we suspected manufacturers were gradually phasing out the use of flame retardants in children’s products. It appears our regulations helped accelerate that trend,” it added. A California bill (AB 2998) was signed into law last autumn that will ban the use of all flame retardants above 1,000ppm in upholstered furniture and children’s products, effective in 2020. The statute directs a separate state agency – the Bureau of Electronic and Appliance Repair, Home Furnishings, and Thermal Insulation (Bearhfti) – to conduct testing to ensure compliance. Further information is available at:

- Report
- Priority product page

Chemical Watch, 12 February 2019

<http://chemicalwatch.com>

## EUROPE

### UK, Finland dissent led to withdrawal of PFHxA SVHC proposal

2019-02-21

Germany’s withdrawal of its proposal to name PFHxA and its ammonium salt an SVHC last December, came after dissent from the UK and Finland, minutes from an ECHA committee reveal. The diverging positions adopted by EU member states on the PFAS compound could prove significant in the wider debate about how REACH’s equivalent level of concern (Eloc) principle should be interpreted for environmental pollutants. The Eloc principle was central to Germany’s proposal. The difference of opinion, and the withdrawal of the proposal, came during December’s meeting of ECHA’s Member States Committee (MSC), the minutes for which were published on 12 February. In a joint statement, included in the minutes, 17 other EU member states expressed explicit support for the SVHC proposal. However, in the face of some dissent, Germany withdrew the intention to avoid “an undesirable delay in risk management”. Germany submitted an SVHC proposal for PFHxA and its ammonium salt last year and ECHA ran a public consultation, which ended in October. However,

**Diverging positions could prove significant in debate over REACH’s Eloc principle**

## Regulatory Update

### CHEMWATCH

at the MSC meeting, the UK and Finland suggested a “timeout” for the proposal, to allow for policy agreement on the use of the Eloc principle for environmental pollutants. Historically, Eloc has been used to identify SVHCs on account of skin sensitisation and endocrine disruption. In a statement published last year, Cefic described the idea of using the principle for environmental pollutants as “premature” and called for a policy paper on the subject. Germany is now preparing a restriction proposal for the substance. The authorities are increasingly seeking to control the uses of PFAS compounds through regulation, owing primarily to their persistence in the environment. As a class, the compounds are best known for their use in stain-repellent coatings and fire-fighting foams. PFHxA is not manufactured in, or imported into, the EU, but is a degradation product of other PFAS compounds. An industry-funded review of PFHxA, published in January, recommended “continued environmental monitoring to confirm that levels do not rise over time” as well as further study of children’s exposure to the chemical.

#### Chair concerns

Meeting attendees also discussed an “EU government relations law firm” that, according to the minutes, approached many EU permanent representatives, member state competent authorities and the MSC secretariat about PFHxA before the meeting. The firm, acting on behalf of a company, asked for the opportunity discuss their comments on the proposal and for these to be shared with the committee. The chair, ECHA’s Watze de Wolfe, declined these requests because neither the firm nor the company had submitted comments for the public consultation, and he did not want to create a “privileged situation”. He also wrote to the firm expressing his “concerns”. Neither the firm nor the company are named in the minutes. Further information is available at: Minutes

Chemical Watch, 14 February 2019

<http://chemicalwatch.com>

### **The New EU Single-use Plastics Directive EU to Adopt Law on the Reduction of the Impact of Certain Plastic Products on the Environment**

2019-02-21

In the morning of 19 December 2018, the EU co-legislators Council and European Parliament (EP) agreed on the text of the so-called Single-use Plastics Directive (Directive) after a negotiating session that had lasted

**The Directive includes measures that the EU Member States will, in general, have to take by 2021 regarding specifically identified categories of single-use plastic (SUP) products**

## Regulatory Update

CHEMWATCH

for more than 12 hours. The Directive includes measures that the EU Member States will, in general, have to take by 2021<sup>1</sup> regarding specifically identified categories of single-use plastic (SUP) products (and fishing gear containing plastic). The European Commission (EC) adopted a broader Plastics Strategy in January 2018. In this context, the EC proposed the SUP Directive in May 2018. The EP, following the adoption of a draft report by its Environment Committee (ENVI), voted in plenary to enter into negotiations with the Council in October 2018. At the end of the same month, ambassadors of the EU Member States in the Committee of Permanent Representatives (COREPER) gave the Council Presidency a mandate to enter into such negotiations (so-called “trilogues”). In total, Council and EP held three trilogue meetings, with the EC present, and nine technical meetings. The is the result of these negotiations.

### Summary of the Directive

#### I. Legal basis, Objective, Scope, and Relationship to Other EU laws

##### Legal Basis and Objective Pursued

The Directive is based on the EU competence for environmental action. As such, it does not prevent any Member State from maintaining or introducing more stringent protective measures. Such measures must be compatible with the Treaties and notified to the EC (Article 193 of the Treaty on the Functioning of the EU; so-called protection clause). They do not need approval by the EC. The objectives of the Directive are to prevent and reduce the impact of certain SUP products on the environment, in particular, the aquatic environment, and on human health, as well as to promote the transition to a circular economy with innovative and sustainable business models, products and materials, thus also contributing to the efficient functioning of the internal market. Recital 2 explains that the Directive promotes circular approaches that prioritise sustainable, non-toxic, reusable products over single-use products, aiming first and foremost at waste prevention, as well as retaining the value of products and materials for as long as possible. Recital 3 states that the EU must play its part in preventing and tackling marine litter and aim to be a standard setter for the world.

##### Scope – Who and What Will Be Affected?

The proposal directly affects “producers”. Producers are effectively everybody established in a Member State who professionally manufactures, fills, sells or imports *and* places on the market of that Member State SUP products, as well as those established in another

## Regulatory Update

### CHEMWATCH

Member State or in a third country who professionally sell SUP products directly to users. The definition is particularly important to determine who bears the extended producer responsibility under the Directive (see below). The co-legislators extended the definition of producer (again) to points of sale to end consumers, i.e. shops – but only if the placing on the market takes place there, i.e. the first making available of a product on the market. “Plastic” is defined as a material consisting of a polymer within the meaning of Article 3(5) of the REACH Regulation 1907/2006, to which additives or other substances may have been added, and “which can function as a main structural component of final products, with the exception of natural polymers that have not been chemically modified” within the meaning of Article 3(40) REACH [emphasis added]. This definition is meant to exclude from its scope paints, inks, and adhesives but include biobased and biodegradable plastics. The co-legislators deleted an exclusion of coatings that the EC had proposed. In order to achieve its objective, the proposal provides a very broad definition of “single-use plastic product” as “made wholly or partly from plastic [and] not conceived, designed and placed on the market to accomplish, within its life span, multiple trips or rotations by being returned to a producer for refill or re-used for the same purpose for which it was conceived [emphasis added]”. Several kinds of measures would apply to specific SUP product categories listed in an Annex, which effectively defines the scope of the proposal in the most part and includes specific criteria for some categories to distinguish SUP products from plastic products that do not fall within the scope of the Directive. As a product made partly from plastic can be a SUP product, even the smallest share of plastic within the provided definition, e.g. coating or the lining of a paper cup makes it a plastic product. The co-legislators clarified that products that are returned to another producer for refill, e.g. in return schemes in which multiple producers cooperate, are multi-use products out of the scope of the Directive. Recital 12 explains that SUP products “are typically intended to be used just once or for a short period of time before being disposed of [emphasis added]”. This phrasing still, in principle, includes products with a very long use phase, such as insulation, as they are typically intended to be used just once before being disposed of.

#### Relationship to Other EU Laws (*Lex Specialis*)

The recitals generally explain that proper waste management remains essential for the prevention of all litter. However, the impact of existing EU legislation on marine litter is not sufficient. The Directive provides generally that where its rules conflict with the Packaging and Packaging

## Regulatory Update

CHEMWATCH

Waste Directive 94/62 or the Waste Framework Directive 2008/98, the rules in the SUP Directive shall prevail. Recital 9 explains that the SUP Directive is *lex specialis* to these other Directives. However, the recital adds: “This is the case for restrictions on placing on the market”, whilst “[i]n particular with regard to consumption reduction measures, product requirements, marking requirements and extended producer responsibility [the SUP] Directive [only] *supplements*” the other two Directives [emphasis added]. Article 4 on consumption reduction provides that Member States may take marketing restrictions, i.e. bans, in derogation from Article 18 of the Packaging and Packaging Waste Directive 94/62 “for the purposes of prevention of littering of *those products* in order to ensure that those products are substituted with alternatives that are reusable or do not contain plastic [emphasis added].” Article 18 of the Packaging and Packaging Waste Directive enshrines the freedom to place packaging on the market, which satisfies the provisions of that directive. The provided grounds for a derogation from Article 18 are narrower than the general objectives of the SUP Directive. Whilst this is not absolutely clear what “those products” refers to – SUP products in general (as referenced in the preceding sentence) or only those SUP products listed in part A of the Annex (please see below) – the better systematic argument is for the latter, as the next sentence refers to only those products listed in part A of the Annex again. According to Article 11, the measures that Member States take to transpose the Directive shall comply with EU food law.

### II. Measures – How Will SUP Products Be Affected?

The Directive foresees various measures for several product categories that partly overlap, i.e. some product categories are addressed by multiple measures.

#### Consumption Reduction

Member States will have to take the necessary measures to achieve an “ambitious and significant” and “measurable quantitative” reduction in the consumption of certain SUP products by 2026 compared to 2022. To this end, the Directive provides for notification, planning, monitoring and reporting obligations of the Member States – eventually “with a view to the establishment of binding quantitative [EU] targets”. Thus, the Directive does not set specific quantitative consumption reduction targets. The proposal does not proscribe which measures Member States should take to achieve this consumption reduction. However, these measures may include the use of national consumption reduction targets or targets on a minimum percentage of reusable packaging placed on the market or

## Regulatory Update

### CHEMWATCH

maintaining or introducing economic instruments such as charges at the point of sale. The SUP products whose consumption must be reduced are:

- Cups for beverages, including their covers and lids
- Food containers

Defining SUP food containers and distinguishing them from food packaging outside of the scope of the SUP Directive received particular attention during the legislative process. The Annex now includes a uniform description of food containers as: receptacles such as boxes, with or without a cover, used to contain food that is intended for immediate consumption, either on-the-spot or take-away, is typically consumed from the receptacle *and* is ready to be consumed without any further preparation, such as cooking, boiling or heating, including food containers used for fast food or other meal ready for immediate consumption, except beverage containers, plates and packets and wrappers containing food. In addition to the criteria listed in the Annex, Article 12 provides that in order to determine whether a food container is to be considered as a SUP product, "its tendency to be littered, due to its volume or size, in particular, single-serve portions, plays a decisive role." Recital 12 provides as examples for food containers to be considered as SUP products: fast-food containers or meal, sandwich, wrap and salad boxes with cold or hot food, or food containers of fresh or processed food that does not need further preparation, such as fruits, vegetables or desserts, *but not* those for dried food or food that is sold cold requiring further preparation, containers containing food in more than single-serve portions or single-serve portion-sized food containers sold in more than one unit.

### Restrictions

From two years after the entry into force of the Directive, i.e. likely not before early Q2 2021, Member States will have to ban *all* products made of oxo-degradable plastic (irrespective of whether they fit the definition of SUP products or not). The Directive defines oxo-degradable plastic as plastic materials that include additives which through oxidation lead to the fragmentation of the plastic material into micro-fragments or to chemical decomposition, as well as:

- Cotton bud sticks (except if they fall within the scope of the Medical Devices Directives)
- Cutlery (forks, knives, spoons, chopsticks)
- Plates

## Regulatory Update

CHEMWATCH

- Straws (except if they fall within the scope of the Medical Devices Directives)
- Beverage stirrers
- Food containers, beverage containers and cups for beverages made of expanded polystyrene

Whilst the EC proposal did not address any plastic material specifically, the final draft Directive hence insofar addresses specifically oxo-degradable plastic, expanded polystyrene and PET.

### Product Requirements, Including Mandatory Minimum Recycled Content

From 5 years after the entry into force, beverage containers with a capacity of up to three litres, which have caps and lids made of plastic, may be placed on the market only if the caps and lids remain attached to the container during the product's intended use stage. For these purposes, metal caps or lids with plastic seals shall not be considered to be made of plastic. Beverage containers are receptacles used to contain liquid such as beverage bottles and composite beverage packaging, including their caps and lids, but not glass and metal beverage containers that have caps and lids made from plastic (with a specific exemption for special medical purposes). The EC is tasked with requesting the European standardisation organisations to develop harmonised standards relating to this within three months after the entry into force. From 2025, beverage bottles with Polyethylene Terephthalate as the major component (PET bottles) must contain at least 25% recycled plastic, calculated as an average for all PET bottles placed on the market on the territory of each Member State. From 2030, all SUP beverage bottles must contain at least 30% recycled plastic, calculated as before.

### Marking Requirements

From two years after the entry into force, the following products must bear a conspicuous, clearly legible and indelible marking on their packaging or on the product itself:

- Sanitary towels (pads) and tampons and tampon applicators
- Wet wipes, i.e. pre-wetted personal care and domestic wipes
- Tobacco products with filters and filters marketed for use in combination with tobacco products
- Cups for beverages

The marking must inform consumers of the appropriate waste management options or waste disposal means to be avoided for that

## Regulatory Update

CHEMWATCH

product, as well as the presence of plastics in the product and the resulting negative environmental impacts of littering or other inappropriate waste disposal of the products.

The EC is tasked to establish harmonized marking specifications in an implementing act.

### Extended Producer Responsibility (EPR)

The Directive provides for differentiated EPR regimes for packaging and non-packaging SUP products, in general, to be implemented by the end of 2024. However, existing EPR schemes established before July 2018 must be adapted by 5 January 2023. The Packaging and packaging Waste Directive 94/62, as recently amended by Directive 2018/852, provides that Member States have to establish EPR schemes for all packaging by the end of 2024. Producers of:

- Food containers, as defined before
- Packets and wrappers made from flexible material containing food that is intended for immediate consumption from the packet or wrapper without any further preparation
- Beverage containers, as defined before
- Cups for beverages, including their covers and lids

Lightweight plastic carrier bags as defined in Article 3(1c) of Directive 94/62/EC shall cover the costs pursuant to the general rules on EPR and, insofar as not already included, (a) the costs of the awareness-raising measures referred to in Article 10 regarding those products; (b) the costs for the collection of waste of those products discarded in public collection systems, including infrastructure and its operation, and its subsequent transport and treatment; and (c) the costs to clean up litter of those products and its subsequent transport and treatment. Producers of:

- Wet wipes, i.e. pre-wetted personal care and domestic wipes
- Balloons, except balloons for industrial or other professional uses and applications, that are not distributed to consumers,

shall cover the costs of (a) the awareness-raising measures referred to in Article 10 regarding those products; (b) the costs to clean up litter of those products and its subsequent transport and treatment; and (c) of data gathering and reporting. Hence, the producers of product falling into these two categories do not have to cover the cost of collection, including infrastructure. By January 2023, the producers of tobacco products with filters and filters marketed for use in combination with

## Regulatory Update

CHEMWATCH

tobacco products shall, *in addition*, cover the costs of collection of waste of those products discarded in public collection systems, including infrastructure and its operation, and its subsequent transport and treatment. This may include the *setting up of* specific infrastructure for the collection of waste of those products, such as appropriate waste receptacles in common litter hotspots. The costs to be covered shall not exceed the costs that are necessary to provide those services in a cost-efficient way and shall be established in a transparent way between the actors concerned. The costs to clean up litter shall be proportionate and limited to activities undertaken by public authorities or on their behalf. To minimize administrative costs, Member States may determine financial contributions to clean up litter by setting appropriate multiannual fixed amounts. The Directive introduces a system of authorised representatives amongst the Member States for the purpose of producers fulfilling their EPR obligations.

### Separate Collection

Member States shall take the necessary measures to collect separately *for recycling, no later than by 2025, 77% of the waste from SUP beverage bottles with a capacity of up to three litres, including their caps and lids, but not glass and metal beverage bottles that have caps and lids made from plastic (excluding bottles for special medical purposes). No later than by 2029, 90% of the waste from such SUP beverage bottles must be collected separately for recycling.* SUP beverage bottles placed on the market within a Member State may be deemed to be equal to the amount of waste generated of such products, including waste littered. In order to achieve this target, Member States *may, among others*, establish separate collection targets for relevant EPR schemes or establish deposit refund systems.

### Awareness Raising

*By two years after entry into force (i.e. the general transposition deadline, see below), Member States shall take measures to inform consumers and to incentivise responsible consumer behaviour, in order to achieve a reduction in the littering of products covered by this Directive.*

With regard to:

- Food containers, as defined before
- Packets and wrappers made from flexible material, as defined before
- Beverage containers, as defined before

## Regulatory Update

### CHEMWATCH

- Cups for beverages
- Tobacco products with filters and filters marketed for use in combination with tobacco products
- Wet wipes, as defined before
- Balloons, as defined before
- Lightweight plastic carrier bags as defined in Article 3(1c) of Packaging and Packaging Waste Directive 94/62
- Sanitary towels (pads) and tampons and tampon applicators

Member States shall take measures to inform consumers about (a) the availability of reusable alternatives, re-use systems, and waste management options for those products, as well as best practices in sound waste management carried out in accordance with Article 13 of Waste Framework Directive 2008/98; (b) the impact of littering and other inappropriate waste disposal of those products on the environment, and in particular on the marine environment; (c) as well as the impact on the sewer network of inappropriate waste disposal of those products. As with separate collection, the phrasing implies that Member States have to organise these measures *themselves*. This is particularly relevant because producers would have to cover the costs for these measures.

#### C. Adoption, Implementation, Enforcement, and Evaluation

##### Adoption

The SUP Directive has been going through the approval processes in both the Council and EP. COREPER and ENVI endorsed it on 18 and 22 January, respectively. It is expected to be adopted without changes in March 2019. It will enter into force after being published in all official languages of the EU in its Official Journal (OJ).

##### Implementation

In general, Member States will have two years from that date to transpose it into their national laws, making the rules of the SUP Directive directly applicable to economic operators. The SUP Directive gives the EC multiple mandates to adopt implementing acts on:

- The methodology for calculation and verification of consumption reduction measures (within 18 months from the entry into force), of the separate collection targets (effectively within 12 months from the entry into force), of recycled content in beverage bottles (January 2022)

## Regulatory Update

CHEMWATCH

- Harmonised specifications for marking requirements (effectively within 12 months from the entry into force)
- The format for reporting data (effectively within 12 months from the entry into force; except for information on recycled content in beverage bottles: January 2022)

The Directive also charges the EC with publishing guidelines “including examples of what is to be considered a single-use plastic product” (within 12 months from the entry into force) and for criteria on the cost to clean up litter (no explicit time limit). Recital 12 indicates that the guidelines on the definition of single-use plastic products should encompass all product categories listed in the Annex, including food containers.

### Enforcement

Member States must lay down the rules on effective, proportionate and dissuasive penalties applicable to infringements of national provisions adopted pursuant to the Directive and shall take all measures necessary to ensure that they are implemented. However, the co-legislators deleted specific access to justice rules (in favour of NGOs, amongst others) from the EC proposal.

### Evaluation

Within six years after the transposition deadline, i.e. likely by 2027, the EC shall carry out an evaluation of the Directive and submit a report, accompanied by a legislative proposal, if appropriate. The report shall include assessments of:

- (a) the need to review the Annex, including in particular regarding caps and lids made of plastics used for glass and metal beverage containers;
- (b) the change in materials used in the SUP products covered by the Directive, as well as of new consumption patterns and business models based on reusable alternatives; this shall, wherever possible, include an overall life-cycle analysis to assess the environmental impact of such products and their alternatives;
- (c) the scientific and technical progress concerning criteria or a standard for biodegradability in the marine environment applicable to SUP products within the scope of the Directive and their single-use substitutes, which ensure full decomposition into CO<sub>2</sub>, biomass and water within a timescale short enough for the plastics not to be harmful for marine life and not lead to an accumulation of plastics in the environment.

## Regulatory Update

CHEMWATCH

With this, the co-legislators set a high bar for biodegradable SUP products to be possibly exempted from the Directive in the future: *marine* biodegradability. A separate report shall consider the options for binding measures for the reduction of the post-consumption waste of tobacco products with filters and filters marketed for use in combination with tobacco products, including the possibility for setting binding collection rates for the post-consumption waste of these products.

National Law Review, 13 February 2019

<http://www.natlawreview.com>

### Germany AwSV List of published WGK classifications updated

2019-02-21

On 19 February 2019, the German Ordinance on Facilities Handling Substances That Are Hazardous to Water (AwSV) List of published water hazard class (WGK) classifications was updated. The following substances were newly assigned a WGK:

- Alcohols, C16-18 and C18-unsatd., ethoxylated (15 - 20 mol EO): WGK 1 (slightly hazardous to water)
- L-alpha-(aminomethyl)-3,4-dihydroxybenzyl alcohol hydrochloride: WGK 1 (slightly hazardous to water)
- Benzeneacetic acid, 4-(4-chloro-1-oxobutyl)-alpha, alpha-dimethyl-, ethyl ester: WGK 2 (obviously hazardous to water)
- 1,2-Benzenediol, 4-[(1R)-2-amino-1-hydroxyethyl]-: WGK 1 (slightly hazardous to water)
- 11,2-Benzenediol, 4-[(1R)-2-amino-1-hydroxyethyl]-, (2R,3R)-2,3-dihydroxybutanedioate, hydrate (1:1:1): WGK 1 (slightly hazardous to water)
- Cyclopentanepropanoic acid, alpha-(acetylamino)-2-oxo-, methyl ester: WGK 1 (slightly hazardous to water)
- N-(cyclopent-1-en-1-yl)pyrrolidine: WGK 1 (slightly hazardous to water)
- (2S)-2-[[[(2R)-1-ethoxy-1-oxo-4-phenylbutan-2-yl]azaniumyl]propanoate: WGK 1 (slightly hazardous to water)
- (S)-2-Ethyl-2-mercaptomethyl hexan-1-ol: WGK 2 (obviously hazardous to water)
- 4-(2-((3-Ethyl-4-methyl-2-oxo-3-pyrrolin-1-yl)carboxamido)ethyl)phenylsulfonamid: WGK 1 (slightly hazardous to water)

**On 19 February 2019, the German Ordinance on Facilities Handling Substances That Are Hazardous to Water (AwSV) List of published water hazard class (WGK) classifications was updated.**

## Regulatory Update

### CHEMWATCH

- Magnesium [(2,3-dihydro-1,5-dimethyl-3-oxo-2-phenyl-1H-pyrazol-4-yl)methylamino]methanesulphonate: WGK 1 (slightly hazardous to water)
- Methanesulfonic acid, 1-[(2,3-dihydro-1,5-dimethyl-3-oxo-2-phenyl-1H-pyrazol-4-yl)methylamino]-, sodium salt, hydrate (1:1:1): WGK 1 (slightly hazardous to water)
- Methylprednisolone: WGK 2 (obviously hazardous to water)
- Pregn-4-ene-3,20-dione, 11,17,21-trihydroxy-, (11b)-: WGK 2 (obviously hazardous to water)
- Reaction mass of calcium bis(dihydrogenorthophosphate) and calcium hydrogenorthophosphate: WGK 1 (slightly hazardous to water)
- Sulfamic acid, N-(2,3-dihydro-1,5-dimethyl-3-oxo-2-phenyl-1H-pyrazol-4-yl)-: WGK 1 (slightly hazardous to water)
- Tetrapotassium pyrophosphate: WGK 1 (slightly hazardous to water)

Yorda's Hive, 20 February 2019

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

## REACH Update

CHEMWATCH

### High-volume plastic additives mapped

2019-02-22

The European Chemicals Agency (ECHA) and industry have mapped a range of high-volume chemicals that are used as additives in plastic. The information will be used by ECHA to identify substances of priority for further assessment. Information on over 400 substances used in the EU as additives in plastics is now available on ECHA's website. The listing is based on the technical functions of additives and data provided by industry on substances manufactured or imported at above 100 tonnes per year. It covers substances used as antioxidants, antistatics, flame retardants, nucleating agents, plasticisers, pigments, heat stabilisers, and UV/light stabilisers. Information on the polymer types that the additives are most commonly found in and the expected concentration ranges is also provided. The work included the development of a methodology for comparing the potential of additives to be released from plastic articles during their use. Together with information on hazard potential, the use and release information will be used by ECHA and Member States in the prioritisation of groups of substances for in-depth assessment under REACH. Through its results, the project aims to assist industry in identifying what use and exposure information is relevant to determine safe use for substances in articles and hence trigger a need for updating their registration dossiers. This information should be included in registrations and also communicated down the supply chains. Comparing the release potential of additives with the same technical function can also help in the substitution of hazardous substances with safer alternatives. The project was launched in 2016 and was carried out in cooperation with 21 industry sectors, including both additive manufacturers and downstream users. It contributes to meeting the 2020 goals of the World Summit on Sustainable Development and to the EU's Strategy for Plastics in the Circular Economy. Further information is available at:

- [Plastic additives initiative](#)
- [Mapping exercise](#)
- [ECHA Newsletter 1/2019: Mapping plastic additives](#)

ECHA, 21 February 2019

<http://echa.europa.eu>

**The European Chemicals Agency (ECHA) and industry have mapped a range of high-volume chemicals that are used as additives in plastic.**

## REACH Update

CHEMWATCH

### REACH 2018 registration data now included in QSAR Toolbox

2019-02-22

The update to the QSAR Toolbox integrates data from REACH registrations up to November 2018, including data from the last REACH registration deadline for low production volume substances. Version 4.3 of the OECD QSAR Toolbox contains REACH registration data up to November 2018. 668 041 selected experimental data points for 11 735 chemicals are now available, including data from the REACH 2018 registration deadline. More data has been made available particularly on aquatic toxicity, sensitisation, and irritation and corrosion, which will help governments, industry and stakeholders to fill in data gaps for assessing chemical hazards. Crucial to this work is the grouping of chemicals into categories. The update makes more tools available to support how analogues and chemical categories are defined, including:

- a database on adsorption, distribution, metabolism and elimination (ADME) properties and related profilers that can be used to support the development of category hypotheses;
- 159 new (Q)SAR models; and
- a (Q)SAR editor that makes it possible to edit, import and create custom profilers and custom (Q)SAR models by linking to an external computational platform.

Software developers can now build their own extensions for the toolbox, or integrate toolbox functionalities in their own software thanks to the addition of an application program interface (API). Together with the release of this version, a completely redesigned website of the QSAR Toolbox is now also online.

#### What is the OECD QSAR Toolbox?

The QSAR Toolbox is a free software application that supports reproducible and transparent chemical hazard assessment. It offers functionalities for retrieving experimental data, simulating metabolism and profiling properties of chemicals. These information and tools can be used to find structurally and mechanistically defined analogues and chemical categories, which can serve as sources for read-across and trend analysis for data gap filling.

Further information is available at:

- [Redesigned QSAR Toolbox website](#)

**The update to the QSAR Toolbox integrates data from REACH registrations up to November 2018, including data from the last REACH registration deadline for low production volume substances.**

## REACH Update

CHEMWATCH

- [QSAR Toolbox web page](#)

ECHA, 18 February 2019

<http://echa.europa.eu>

### REACH compliance – an Agency priority for 2019

2019-02-22

Many of the registration dossiers received by the European Chemicals Agency (ECHA) do not include all of the required information. This lack of information could mean that potential risks posed by the substances are not being managed properly. ECHA's Executive Director *Bjorn Hansen* tells how the Agency intends to tackle the challenge of non-compliant data and to reduce the uncertainties around potential substances of concern. In early October 2018, the German Federal Institute for Risk Assessment (BfR) published their [study on REACH compliance](#). The study is based on information available in REACH registration dossiers for substances in volumes of 100 tonnes per year or more. The results indicated that between one and two thirds of registrations in the highest tonnage bands are in breach of REACH information requirements. This is similar to the observations gathered by ECHA during its compliance checks.

#### Missing information raises concerns

When REACH was first created, a certain level of non-compliance was expected. Today, the issue is the observed extent of it. "Back then, it was thought that for finding non-compliances it would be enough if ECHA would check five per cent of the registration dossiers in each tonnage band," Mr Hansen says. At this point, however, it has become clear that checking the compliance to this extent has not had the planned effect. "REACH was built purposely so that industry does its job and then we at ECHA check whether what they have done is sufficient. This means that industry should do its best to fulfil the requirements and, in particular, do so where possible without testing on animals," Mr Hansen points out. The fact that alternatives to animal testing have not been developed at the expected pace is problematic for industry. Since animal testing is only allowed as a last resort, registrants have used derogations more than was expected. The pressure towards using data waivers may lead to a situation where a substance is assumed to be less hazardous than what it really is. "The absolutely crucial point is that where non-compliance exists, there may be effects of a chemical which go unnoticed. This is, of course, not the case for all non-compliant dossiers, but it is an underlying worry," Mr Hansen explains.

**Many of the registration dossiers received by the European Chemicals Agency (ECHA) do not include all of the required information.**

## REACH Update

CHEMWATCH

### Making compliance check an Agency priority

Although checking the regulatory compliance of registration dossiers has been a core task of the Agency since its early days, there will be an even greater focus on compliance check this year. According to Mr Hansen, this means that the Agency will need to free up resources so that more work can be done on dossier compliance. It is important to make use of the staff experience gained during the years of working on compliance tasks to improve efficiency and implement smarter ways of working. Since 2010, ECHA has gradually moved from compliance checks that were based on random selection of dossiers to an approach where the focus is mainly on those substances that matter the most for human health and the environment. This targeting can be done with the help of screening tools. With ECHA looking to continue with this approach, Mr Hansen emphasises the importance of smart compliance checks and the efficient use of resources. "A compliance check of a dossier where the substance is non-hazardous but the data is non-compliant requires exactly the same amount of work as a check where the substance is hazardous and the information non-compliant. Therefore, it is more effective and serves European citizens better if we focus on those substances that we suspect to be hazardous."

### Aiming to deliver more

Both civil society and the European Commission have expressed their concern over the low dossier compliance. As deficiencies in dossiers can be addressed through compliance check decisions, Mr Hansen expects ECHA to be asked to perform more compliance checks already during 2019. "I would think that the Commission would want to raise the number of compliance checks from the current percentage because there is more non-compliance than what we originally expected. We are already planning for this and are increasing our efforts to make sure that we can deliver on the promise of protecting European citizens. So, it all fits together." Delivering more does not only mean an increased number of checks. "For me, what matters is that we learn to do our work better, and are more efficient and focused. For example, if the end result is not a massive increase in numbers, but instead, we get better at identifying substances with non-compliant data that we suspect to be hazardous, then that is also worthwhile. So, the same number of compliance checks could result in more decisions. For me, that would be a success. This Agency has a lot of competence and a high level of motivation and commitment," Mr Hansen says and continues, "so all the prerequisites for

## REACH Update

CHEMWATCH

being able to respond to the potential request from the Commission are there.”

### How can we encourage updates?

Even though ECHA checks compliance, it is industry’s responsibility to make sure that its dossiers actually are compliant. Regardless of whether the interpretation that companies are not updating their dossiers to the necessary degree is correct, ECHA strongly encourages companies to be proactive in updating their information. “One of the ways in which we encourage companies to update is through our cooperation with industry associations. For example, we have discussed how to improve dossiers and tailor them better to the needs of authorities and of the companies themselves with Eurometaux, the petroleum industry and Cefic,” Mr Hansen explains. The ultimate aim of this work is to help companies update their dossiers with better hazard information and with the use information received from their own supply chains. Eventually, this could lead to a situation where authorities do not need to take an action as the registrations clearly document the safe use. “We do see that companies update their dossiers when we take action. Examples of this could be when we inform them of upcoming compliance checks or restriction intentions. However, when there is no action from us, the amount of updates is limited.” The need for an implementing act to clarify the legal requirements on dossier updates has been increasingly recognised. At the moment, the REACH Regulation states that companies must update their registrations with relevant new information ‘without undue delay’. “I think defining what undue delay actually means is the main element, because legally speaking it is a difficult term to interpret,” Mr Hansen says. He explains that it is not only about it being difficult for companies to know when they need to update their dossiers – it is also difficult for authorities to know when to enforce this.

### We need to work together

The interface between ECHA and national enforcement authorities is another area where further clarification could help the cooperation. ECHA can carry out certain checks in the dossier, but only the Member State enforcement authorities are able to make sure that the information included in the dossier is actually correct. “At ECHA, we can check whether the company has provided an address, a name of a company, a contact person and a telephone number in their registration. However, we cannot verify that they have provided *the* address, *the* name of the company, *the* contact person and *the* telephone number that they should have. The

## REACH Update

CHEMWATCH

national authority can do that. And this is very important, particularly when we get into much more complicated information in the dossier," he points out. However, whether we are talking about the number of compliance checks done, the number of updated dossiers, the compliance of the information or the responsibilities of the different actors in the process, it is evident that everyone's contribution is needed. "This is a regulation which holds very high expectations and a high workload. But while working on our parts, we also have to regularly take a step back, check what is going on, and reflect on whether we are doing things the right way and make changes if we are not. It is just a natural learning curve," he concludes.

ECHA Newsletter, 21 February 2019

<http://echa.europa.eu>

### List of biocides suppliers updated

2019-02-22

An updated Article 95 list of active substance and product suppliers is now available. A biocidal product can be made available on the EU market only if the substance supplier or the product supplier is included in this list for the relevant product-type. Further details are available at:

- [List of biocides suppliers](#)
- [Impact of the UK's withdrawal](#)

### Updated list of intentions to renew active substance approval

2019-02-22

An updated list is available on active substance and product-type combinations for which companies have expressed their interest to renew the approval. If you are interested in the renewal of an active substance for a specific product-type, we encourage you to collaborate to submit the application jointly, in particular to minimise testing on animals. A copy of the list is available at: [List of intentions to renew the approval of active substances](#)

ECHA News, 20 February 2019

<http://echa.europa.eu>

**An updated Article 95 list of active substance and product suppliers is now available.**

## Janet's Corner

CHEMWATCH

### Decrease in Concentration

2019-02-22

**DON'T DRINK WATER WHILE  
STUDYING. BECAUSE  
CHEMISTRY SAYS THAT**



**CONCENTRATION DECREASES  
ON ADDING WATER**

Pinterest

<https://www.pinterest.com.au>

## Hazard Alert

### CHEMWATCH

#### Tungsten

2019-02-12

Tungsten, also known as wolfram, is a chemical element with symbol W and atomic number 74. [1] Based on its purity, the colour of tungsten may range from white for the pure metal to steel-grey for the metal with impurities. It is commercially available in a powdered or solid form. The melting point of tungsten is the highest among metals and it resists corrosion. It is a good conductor of electricity and acts as a catalyst in chemical reactions. Tungsten in the form of finely divided powder is highly flammable and may ignite spontaneously on contact with air. Powdered tungsten may also cause fire or explosion on contact with oxidants. [2]

#### USES [3]

Tungsten is used in filaments in incandescent light bulbs, it is also used in electric contacts and arc-welding electrodes. Tungsten is used in alloys, such as steel, to which it imparts great strength. Cement carbide is the most important use for tungsten: its main component is tungsten carbide (WC). It has the strength to our cast iron and it makes excellent cutting tools for the machining of steel. X-ray tubes for medical use have a tungsten emitter coil and the screen used to view X-rays rely on calcium and magnesium tungstate phosphors to convert X-rays into blue visible light. Tungsten is also used in microchip technology and liquid crystals displays.

#### IN THE ENVIRONMENT [4]

- Tungsten is an element that exists naturally in the environment.
- It is an element that cannot be formed or destroyed.
- Tungsten in water comes mainly from water dissolving tungsten from rocks and soil that it runs over or through.
- Tungsten in air comes from the weathering of rocks, from the mining of tungsten ore, or from emissions from industries making tungsten metal or hard metal products.
- Tungsten particles in air can settle out onto soil, water, or plant surfaces, or they can be brought down in rain or snow.
- Water and air are not normally tested for tungsten.
- If coal ash, incinerator ash, or industrial waste contains high levels of tungsten, it can increase the levels in soil with which it is mixed.

**Tungsten, also known as wolfram, is a chemical element with symbol W and atomic number 74.**

## Hazard Alert

### CHEMWATCH

- Most tungsten in soil binds with the soil and will not reach groundwater.
- As soil conditions change, tungsten may dissolve out of soil and rocks in one location and bind back to soil and rocks in another location.

### SOURCES & ROUTES OF EXPOSURE [5]

#### Sources of Exposure

##### General Populations

- The general population may be exposed to tungsten in ambient air and food.

##### Occupational Populations

- Occupational exposure to tungsten and its compounds occurs during the production of tungsten metal from the ore and preparation of tungsten carbide powders.
- Exposure to cemented tungsten carbide can occur during the manufacturing and grinding of cemented tungsten carbide hard metal parts.
- Workers can also be exposed to dusts and mists of tungsten and its compounds or cemented tungsten carbide during crushing, mixing, ball milling, loading and unloading, and grinding operations.

#### Routes of Exposure

- Inhalation (breathing) – A route of typically low exposure for the general population. Predominant route of exposure for tungsten and hard metal workers.
- Oral (mouth) – A route of typically low exposure to tungsten is via ingestion of food and water.
- Dermal – Minor route of exposure.

### HEALTH EFFECTS [3]

Tungsten has been shown to act by antagonising the action of the essential trace element, molybdenum. Long industrial experience has indicated no pneumoconiosis to develop among workers exposed solely to W or its insoluble compounds (at air concentrations of the order of 5 mg/m<sup>3</sup>).

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CHEMWATCH

### Acute Health Effects

- Irritating to the skin and eyes on contact.
- Inhalation will cause irritation to the lungs and mucus membrane.
- Irritation to the eyes will cause watering and redness.
- Reddening, scaling, and itching are characteristics of skin inflammation.

### Chronic Health Effects

- Tungsten has no known chronic effects.
- Repeated or prolonged exposure to this compound is not known to aggravate medical conditions.

### SAFETY [6]

#### First Aid Measures

- Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.
- Skin Contact: If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands, gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

## Hazard Alert

**CHEMWATCH**

- Ingestion: Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

### Fire & Explosion Information

- Tungsten may be combustible at high temperature.
- Small fires should be extinguished using dry chemical powder
- Large fires should be extinguished using water spray, fog or foam. Do not use water jet.
- Tungsten in powder form, may be capable of creating a dust explosion.

### Exposure Controls and Personal Protection

#### Engineering Controls

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

#### Personal Protective Equipment

The following personal protective equipment is recommended when handling tungsten:

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

Personal Protection in Case of a Large Spill:

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

## Hazard Alert

CHEMWATCH

### REGULATION

#### United States [7]

OSHA: The Occupational Safety & Health Administration has set the following Permissible Exposure Limit (PEL):

- Construction Industry: 5 mg/m<sup>3</sup> TWA

ACGIH: The American Conference of Governmental Industrial Hygienists (has set a Threshold Limit Value (TLV) for tungsten of 5 mg/m<sup>3</sup> TWA; 10 mg/m<sup>3</sup> STEL

NIOSH: The National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for tungsten of 5 mg/m<sup>3</sup> TWA; 10 mg/m<sup>3</sup> STEL

#### Australia [8]

Safe Work Australia: Safe Work Australia has established a Time Weighted Average Concentration (TWA) for tungsten of 5 mg/m<sup>3</sup> for a 40-hour work week and a 15-min short term exposure limit of 10 mg/m<sup>3</sup>.

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## Gossip

## CHEMWATCH

### **PFAS and phthalate chemical exposure early in life may hamper kids' lungs**

2019-02-06

Children exposed to three different chemical classes — parabens, phthalates and perfluoroalkyl substances (PFAS)—before birth and shortly after had reduced lung function at 6 and 12 years old, according to a new study. The study, published in *The Lancet Planetary Health*, examined more than 1,000 pairs of children and mothers in Europe and is the first to look at a broad suite of chemical exposure from before and after birth and its impact on child lungs. It suggests that some everyday compounds pregnant women and young children are consistently exposed to may lead to reduced lung function. The findings are important, the authors write, because it shows by “stricter regulation and informing the public by labelling these chemicals in consumer products” we could “help to prevent lung function impairment, which in turn should prevent the development of chronic respiratory disease in adulthood.” Low lung function in childhood can lead to persistent lung problems as an adult, such as chronic obstructive pulmonary disease (COPD). Researchers measured 85 exposures during pregnancy and 125 during early childhood. The children had lung function tests at 6 and 12 years old. The scientists found two types of PFAS chemicals, five phthalate metabolite compounds, one paraben and the metal copper were linked to reduced lung function in the kids. All of the compounds are widespread in the environment: PFAS are stain- and water-repellent chemicals found in cook wear, water repellent clothes, stain-resistant fabric and carpets and increasingly being found in U.S. water supplies; phthalates are found in hundreds of products including personal care products, detergents, diapers, vinyl flooring; and ethyl paraben is used to manufacture plastics, solvents and some personal care products. It's not clear how the chemicals could be impacting lung development, however, previous animal studies found PFAS compounds induced inflammation and altered how airways functioned. Phthalates have previously been shown to affect the immune system development and induce inflammation. The research had limitations: Though they found the associations with the certain chemicals, after they adjusted their results for the multiple tests run, none of the exposures were significantly linked to reduced lung function. A commentary on the study also published today said this limitation indicates “that a single exposure might only have a very small effect.” The commentary also said that, while the data used is the largest amount so far looking at these associations, it's still “relatively small.” However, co-author of the study, Martine Vrijheid, a researcher at ISGlobal, said the approach itself—looking at a large suite

**Study of more than 1,000 mothers and children in Europe links common chemicals to reduced lung function.**

## Gossip

### CHEMWATCH

of dozens of chemicals exposures before and after birth— could chart a new path in teasing out how to prevent contaminants from impacting children’s health. This represents “a new paradigm in environmental health research,” she said in a statement.

Environmental Health News, 5 February 2019

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

### Scientists Invent a Flexible Device That Converts Wi-Fi Signals Into Electricity

2019-02-06

We can probably all agree that charging cables are just the worst, and that we’d love to have fewer of them in our lives. Now, a new invention might give us just that: engineers have developed a flexible device that harvests energy from Wi-Fi signals. And not just harvest. It can then convert it into electricity that could be used to power devices, wire- and battery-free. The device is what is known as a rectenna - a portmanteau of ‘rectifying antenna’ - which is a type of antenna that converts electromagnetic energy into direct current (DC). The new rectenna, from a team led by MIT and the Technical University of Madrid, uses a radio-frequency antenna to capture electromagnetic waves (such as those produced by Wi-Fi) as alternating current (AC) waveforms. These are sent to a two-dimensional semiconductor that converts them into DC, producing about 40 microwatts. It’s not much, but is actually enough to power an LED or to drive silicon chips. Because the rectenna is flexible, it can be deployed over large areas akin to wallpaper, or used in small, portable devices such as flexible smartphones, a field that is desperately trying to emerge. The tech could even be used in medical implants and swallowable sensors. “Ideally you don’t want to use batteries to power these systems, because if they leak lithium, the patient could die,” said engineer Jesús Grajal of the Technical University of Madrid. “It is much better to harvest energy from the environment to power up these small labs inside the body and communicate data to external computers.” This, to be clear, is not the first device that can convert energy from Wi-Fi into electricity. The idea has been around for some time, and engineers are continuing to tinker with it. What the team has done to improve on it is the use of a different material for the rectifier - the part that converts AC into DC. In previous rectennas, it’s been made from a material such as silicon or gallium arsenide, which is not only rigid, but would also be expensive for large areas. In the flexible rectenna, the team used molybdenum disulfide (MoS<sub>2</sub>). It’s just three atoms thick, and, when exposed to certain chemicals,

**Engineers have developed a flexible device that harvests energy from Wi-Fi signals.**

## Gossip

### CHEMWATCH

forces a phase transition between semiconductor and metallic material. The structure is also known as a Schottky diode, mimicking the properties of the metal-semiconductor junction used in rectennas previously - producing a working rectenna that minimises parasitic capacitance, resulting in higher speed. This means it can capture higher frequencies than other flexible rectifiers, which can't capture the gigahertz frequencies in which Wi-Fi operates. "Such a design has allowed a fully flexible device that is fast enough to cover most of the radio-frequency bands used by our daily electronics, including Wi-Fi, Bluetooth, cellular LTE, and many others," explained engineer Xu Zhang of MIT. And it's relatively low cost at larger scales, so it could be used for much bigger applications. "What if we could develop electronic systems that we wrap around a bridge or cover an entire highway, or the walls of our office and bring electronic intelligence to everything around us? How do you provide energy for those electronics?" said engineer Tomás Palacios of the MIT/MTL Centre for Graphene Devices and 2D Systems in the Microsystems Technology Laboratories. "We have come up with a new way to power the electronics systems of the future - by harvesting Wi-Fi energy in a way that's easily integrated in large areas - to bring intelligence to every object around us." The team is now working to build larger systems, and to improve the efficiency of their rectenna. Their paper has been published in the journal Nature.

Science Alert, 29 January 2019

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

### **How diapers and menstrual pads are exposing babies and women to hormone-disrupting, toxic chemicals**

2019-02-06

Most diapers and sanitary pads contain volatile organic compounds and phthalates and with this continued, long-term exposure a significant amount of these harmful chemicals could be absorbed via the genitals, according to a new study. The study was spurred by an investigation from South Korean media outlets in 2017 that found new sanitary pads might be causing menstrual problems and irregularities and was broadened to the U.S. and other countries. More than 15,000 women complained and signed onto a class action lawsuit claiming harm from menstrual pads by the company Lillian. The pads were removed from the market. Women alleged rashes, infections, irregular periods and bad cramping. Scientists and advocates say the exposure uncovers a gap in our regulation of baby's diapers and is emblematic of our society's historical unease with

**Most diapers and sanitary pads contain volatile organic compounds and phthalates and with this continued, long-term exposure a significant amount of these harmful chemicals could be absorbed via the genitals, according to a new study.**

## Gossip

### CHEMWATCH

having productive conversations about women's reproductive health. "The physical location of the exposure site, the high absorption rate of the genitalia for chemicals, and the long-term exposure period demand a thorough investigation on the potential impact of the exposure to VOCs and phthalates," the authors wrote in the study, which will be published in *Reproductive Toxicology*. Exposure to VOCs increases the risk of brain impairment, asthma, disabilities, certain cancers, and the proper functioning of the reproductive system. Phthalates, used as plasticisers in products such as cosmetics, toys, medical devices and other plastics, have been linked to a variety of health concerns including endocrine disruption, impacts to the heart and reproductive systems, diabetes, some cancers, and birth defects. Both sanitary pads—absorbent pads worn by women during menstruation—and diapers are made of synthetic plastics. The scientists tested a handful of brands from each product for certain VOCs — methylene chloride, toluene, and xylene—and four types of phthalates. The study does not name the brands tested, but the products were collected from markets in Korea, Japan, Finland, France, Greece and the United States. For VOCs, the researchers found methylene chloride in two brands of sanitary pads; toluene in nine; and xylene in all 11 brands tested. In diapers, all four brands tested contained toluene and xylene, none contained methylene chloride. For phthalates, the researchers found two types of the chemicals in all 11 brands of sanitary pads tested. In diapers, all four brands contained two types of phthalates, and another type of phthalate was found in one brand. The products had significantly higher levels of phthalates than what is commonly found in plastic goods. Jay Ko CheMyong, senior author of the study and professor & director of Graduate Studies, at Department of University of Illinois at Urbana-Champaign's College of Veterinary Medicine, told EHN he had concerns about outing the brands and "just wanted to provide objective numbers as a scientist." Alexandra Scranton—director of Science and Research for Women's Voices for the Earth, which focuses on women's voices and roles in eliminating the toxic chemicals from products— pointed out "major differences between different brands" when it came to the levels of the compounds. "There was a nearly 6,000-fold difference in levels [of VOCs]," she told EHN. "It tells you that there are a variety of ways these pads are being made – it's not general uncontrolled contamination, there's something intentionally being done" during manufacturing. Scranton was not involved in the study. For phthalates, there was a 130-fold difference between the highest levels in the pads and the lowest. CheMyong said phthalates are used to soften plastics, while VOCs are used as dissolving agents in plastic manufacturing. "Sadly, this is not surprising, but is quite concerning given the contact with reproductive organs," Dr. Leo Trasande,

## Gossip

## CHEMWATCH

a professor in the Departments of Paediatrics, Environmental Medicine and Population Health at New York University's Langone Health, told EHN. "The reality here is that these are very recently collected samples and, as much as there's been a focus on phthalates in toys and contact with kids through their mouth, this raises serious concerns and a need for regulation in these products," he said. Trasande was not involved in the study but is a renowned leader in children's environmental health and just wrote a book, *Sicker, Fatter, Poorer*, about the urgent threat of hormone disrupting chemicals such as phthalates. He said few studies have looked at infant exposures to these chemicals, however, exposure directly to the genitals is worrisome since phthalates inhibit the male sex hormone testosterone and prenatal exposure has been associated with abnormal genital development in boys. "And these exposures are during a critical window on genital development as well as other organs," Trasande said. Children health advocates have for years asked for stricter regulation of baby diapers, which are not considered medical devices by the FDA and therefore not required to go through medical testing to prove their safety. As for the sanitary pads, one health concern is the sheer amount of exposure, Ami Zota, an assistant professor in the Department of Environmental & Occupational Health at the George Washington University Milken School of Public Health, told EHN. "Women are using these products from the age of 12, maybe younger, and almost until 50 – that's like four decades ... once a month," said Zota, who was not involved in the study but whose research focuses on social disparities, environmental exposures, and reproductive and children's health. "That's chronic exposure," she added. Laura Strausfeld — co-founder of Period Equity, an organisation focused on the affordability, safety and availability of menstrual products — told EHN historically there's been more concern over the compounds in tampons, since they're inserted into the vagina. Strausfeld was not involved in the study. But increasingly there is more focus on what harm pads may be causing, she said, as "we've really come to appreciate in the last decade or so that the vagina and genitalia are very effective at absorbing" toxics. Zota said, while the research still isn't settled, it's possible that there may be greater absorption through the vagina than other body parts as contaminants could travel up the reproductive tract. She pointed to her own research that found an association between vaginal douching use and higher phthalate levels. Scranton said a main issue for women's menstrual products, much like diapers, is the lack of disclosure of ingredients. She also pointed out that the limited industry studies often don't take into account chemicals' volatility and only look at potential exposure from the top layer of pads. The lack of research and conversation around the health impacts of menstrual products "is the

## Gossip

## CHEMWATCH

historical and cultural taboo in talking about the vagina," Strausfeld said. However, there seems to be something of a cultural shift. "There are more and more bills passed at the state and federal level to supply menstrual supplies to women who can't afford them or are in prison, or in school," she said. "We're finally starting to talk about this more." But, she adds, this new study begs the question: "What should we be looking at that we haven't been looking at? It seems clear that companies are regularly innovating new products to make them more absorbent and flagrantly using materials and new synthetic plastics that we need to be concerned about."

Environmental Health News, 28 January 2019

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

### **New analysis raises questions about EPA's classification on glyphosate weed killer**

2019-02-06

A little more than a month ahead of a first-ever federal trial over the issue of whether or not Monsanto's popular weed killers can cause cancer, a new analysis raises troubling questions about the U.S. Environmental Protection Agency's (EPA) handling of pertinent science on glyphosate safety. According to the report, which examines the opposing positions taken by the EPA and an international cancer research agency on glyphosate-based herbicides, the EPA has disregarded substantial scientific evidence of genotoxicity associated with weed killing products such as Roundup and other Monsanto brands. Genotoxicity refers to a substance's destructive effect on a cell's genetic material. Genotoxins can cause mutations in cells that can lead to cancer. The EPA classifies glyphosate as not likely to be carcinogenic while the International Agency for Research on Cancer (IARC), which is part of the World Health Organization, classifies it as "probably carcinogenic." The paper was authored by Charles Benbrook, a former research professor who served at one time as executive director of the National Academy of Sciences board on agriculture, and was published in the journal *Environmental Sciences Europe*. It is based on Benbrook's review of EPA and IARC records regarding the types and numbers of glyphosate studies each organization evaluated. "Clearly, compared to EPA's genotoxicity review, the IARC review is grounded on more recent, more sensitive, and more sophisticated genotoxic studies, and more accurately reflects real-world exposures," Benbrook told EHN. Benbrook testified as an expert witness in the first lawsuit to go to trial against Monsanto over claims its glyphosate herbicides cause cancer. The plaintiff in that case, Dewayne "Lee" Johnson,

**Researcher says the EPA has disregarded substantial evidence that the popular herbicide, glyphosate, is linked to cancer**

## Gossip

### CHEMWATCH

won a unanimous jury award of \$289 million last year that the judge in the case cut to \$78 million. Thousands of additional cancer victims have sued Monsanto and the second trial begins Feb. 25 in federal court in San Francisco. Benbrook is also expected to testify for the plaintiff in that case. Monsanto is seeking to exclude Benbrook's testimony at trial, saying he has no expertise in any physical science or field of medicine and no training or degree in toxicology and has never worked at the EPA or other regulatory body. The EPA did not respond to a request for comment. The agency has maintained, however, that its review of glyphosate has been robust and thorough. Glyphosate has low toxicity for humans and glyphosate products can be safely used by following directions on labelled products, according to the EPA. In the new analysis, Benbrook is critical of the EPA's scrutiny of glyphosate herbicides, noting that little weight was given to research regarding the actual formulations sold into the marketplace and used by millions of people around the world. Instead, the EPA and other regulators have mostly pointed to dozens of studies paid for by Monsanto and other companies selling glyphosate herbicides that found no cancer concerns. The EPA has given little attention to several independent research projects that have indicated the formulations can be more toxic than glyphosate alone, according to Benbrook. Indeed, the EPA only started working in 2016—some 42 years after the first glyphosate herbicides came to market – with the U.S. National Toxicology Program to evaluate the comparative toxicity of the formulations. Early results disclosed in 2018 supported concerns about enhanced toxicity in formulations. Several scientists, including from within the EPA's Office of Research and Development (ORD), and from a panel of scientific experts convened by the EPA, have cited deficiencies and problems with the EPA's decision to classify glyphosate as not likely to be carcinogenic to humans. But Benbrook's analysis is the first to look deeply at how and why the EPA and IARC drew such divergent conclusions. Benbrook looked at the citations for genotoxicity tests discussed in the EPA and IARC reports, both those that were published in peer-reviewed journals and the unpublished ones that were presented to the EPA by Monsanto and other companies. Some studies looked at glyphosate alone, and/or glyphosate-based herbicide formulations and some included findings about a substance called aminomethylphosphonic acid (AMPA), which is glyphosate's primary metabolite. Benbrook's analysis found that within the body of available evidence, the EPA relied on 151 studies, 115 of which showed negative results, meaning no evidence of genotoxicity, and only 36 that had positive results. IARC cited 191 studies, only 45 of which showed negative results and 146 of which showed evidence of genotoxicity. IARC said within these studies it found "strong evidence that exposure to

## Gossip

## CHEMWATCH

glyphosate or glyphosate-based formulations is genotoxic..." Benbrook's analysis reports that over the last three years at least 27 additional studies have been published addressing possible mechanisms of genotoxic action for glyphosate and/or formulated glyphosate-based herbicides and all but one of the 27 studies reported one or more positive result. There were 18 positives arising from DNA damage, six associated with oxidative stress, and two with other genotoxicity mechanisms, his paper states. According to Benbrook, the EPA's failure to focus on formulated glyphosate-based herbicides is dangerous because these formulations "account for all commercial uses and human exposures (no herbicide products contain just glyphosate)." More research is needed on real-world exposures, Benbrook concludes.

Environmental Health News, 15 January 2019

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

### Scientists Just Defied Chemistry Basics by Flipping 'Left-Handed' Molecules With Light

2019-02-06

Using a beam of light, chemists have figured out how to turn an asymmetrical molecule into a mirror image of itself, with the asymmetry on the other side. To back up into basic chemistry, a molecule is what we call a particle made up of two or more atoms. For example, water is a molecule consisting of two hydrogen atoms and an oxygen atom, carbon dioxide is two oxygen atoms and a carbon atom, and so on. Many molecules are symmetrical, but not all. And some of these asymmetrical molecules are exact mirror images of each other that cannot be superimposed. Of course, molecules don't actually have tiny atom-scale hands, but chemists call this molecular asymmetry chirality, or even plain old handedness. These chiral molecules can either be left-handed S-molecules (from 'sinister', the Latin word for 'left'), or right-handed R molecules (from 'rectus', the Latin word for 'right'). Now scientists have figured out how to turn an S-molecule into an R-molecule using a technique called excited state proton transfer. "This means we wouldn't have to throw half of a chemical solution away when we only want the right-handed molecules," explained chemist Ken Hanson of the University of Florida. Why would you have to throw half out? The thing is, chirality can be vitally important in pharmacology, as we found out to devastating effect in the late 1950s. You may have heard of the thalidomide disaster. A new drug called thalidomide (C<sub>13</sub>H<sub>10</sub>N<sub>2</sub>O<sub>4</sub>) hit the market in 1957 as a safe sedative and morning sickness for pregnant women. It was

**Scientists have figured out how to turn an S-molecule into an R-molecule using a technique called excited state proton transfer.**

## Gossip

### CHEMWATCH

sold around the world. But when an increasing number of babies were born with birth defects following the introduction of this drug, in 1960 a paediatrician made the connection, and thalidomide was removed from pharmacy shelves. Around 120,000 pregnancies were affected - most ended in miscarriage - but 10,000 babies were born with deformities. As it turned out, (R)-thalidomide was perfectly safe. It was (S)-thalidomide - the left-handed molecule - that was teratogenic, producing developmental defects in embryos. While it isn't the case for all drugs, chirality can affect drug development, since chiral molecules can bind differently to target receptors. It's something chemists have taken into account in the wake of the thalidomide disaster. That's why being able to switch chirality would be a powerful tool for producing drug molecules that all have the same handedness. For this research, the team experimented on an organic molecule called BINOL, popular in synthetic organic chemistry for the development of a wide range of asymmetric catalytic reactions. The effectiveness of these reactions relies on the purity of the left- or right-handedness of the BINOL. The team attached a left-handed amino acid to the BINOL, and directed a beam of blacklight at it. After 60 minutes, what had been a 50-50 mix of (R)- and (S)-BINOL had 31 percent more (R)- than (S)-BINOL. Obviously, that means the sample wasn't pure (R)-BINOL, but the experiment was intended as a proof of concept to determine if the technique could actually work. Now that this has been demonstrated, the team will be working to refine it in the hopes of producing a more pure sample. The team's research has been published in the journal *Chemical Communications*.

Science Alert, 5 February 2019

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

## 'Inkjet' solar panels poised to revolutionise green energy

2019-02-06

What if one day all buildings could be equipped with windows and facades that satisfy the structure's every energy need, whether rain or shine? That sustainability dream is today one step closer to becoming a reality thanks to Polish physicist and businesswoman Olga Malinkiewicz. The 36-year-old has developed a novel inkjet processing method for perovskites -- a new generation of cheaper solar cells -- that makes it possible to produce solar panels under lower temperatures, thus sharply reducing costs. Indeed, perovskite technology is on track to revolutionise access to solar power for all, given its surprising physical properties, some

**A researcher has developed novel inkjet processing method for perovskites -- a new generation of cheaper solar cells -- that makes it possible to produce solar panels under lower temperatures, thus sharply reducing costs.**

## Gossip

### CHEMWATCH

experts say. "In our opinion, perovskite solar cells have the potential to address the world energy poverty," said Mohammad Khaja Nazeeruddin, a professor at Switzerland's Federal Institute of Technology Lausanne, an institution on the cutting-edge of solar energy research. Solar panels coated with the mineral are light, flexible, efficient, inexpensive and come in varying hues and degrees of transparency. They can easily be fixed to almost any surface -- be it laptop, car, drone, spacecraft or building -- to produce electricity, including in the shade or indoors. Though the excitement is new, perovskite has been known to science since at least the 1830s, when it was first identified by German mineralogist Gustav Rose while prospecting in the Ural Mountains and named after Russian mineralogist Lev Perovski. In the following decades, synthesising the atomic structure of perovskite became easier. But it was not until 2009 that Japanese researcher Tsutomu Miyasaka discovered that perovskites can be used to form photovoltaic solar cells.

#### 'Bull's eye'

Initially the process was complicated and required ultra-high temperatures, so only materials that could withstand extreme heat -- like glass -- could be coated with perovskite cells. This is where Malinkiewicz comes in. In 2013, while still a PhD student at the University of Valencia in Spain, she figured out a way to coat flexible foil with perovskites using an evaporation method. Later, she developed an inkjet printing procedure that lowered production costs enough to make mass production economically feasible. "That was a bull's eye. Now high temperatures are no longer required to coat things with a photovoltaic layer," Malinkiewicz told AFP. Her discovery quickly earned her an article in the journal *Nature* and media attention, as well as the Photonics21 Student Innovation award in a competition organised by the European Commission. The Polish edition of the *MIT Technology Review* also selected her as one of its Innovators Under 35 in 2015. She went on to cofound the company Saule Technologies -- named after the Baltic goddess of the sun -- along with two Polish businessmen. They had to assemble all their laboratory equipment from scratch, before multimillionaire Japanese investor Hideo Sawada came on board. The company now has an ultra-modern laboratory with an international team of young experts and is building an industrial-scale production site. "This will be the world's first production line using this technology. Its capacity will reach 40,000 square metres of panels by the end of the year and 180,000 square metres the following year," Malinkiewicz said at her lab. "But that's just a drop in the bucket in terms of demand." Eventually, compact production lines could easily be installed

## Gossip

### CHEMWATCH

everywhere, according to demand, to manufacture perovskite solar panels that are made to measure.

#### Self-sufficient buildings

The Swedish construction group Skanska is testing the cutting-edge panels on the facade of one of its buildings in Warsaw. It also inked a licencing partnership with Saule in December for the exclusive right to incorporate the company's solar cell technology in its projects in Europe, the United States and Canada. "Perovskite technology is bringing us closer to the goal of energy self-sufficient buildings," said Adam Targowski, sustainability manager at Skanska. "Perovskites have proven successful even on surfaces that receive little sunlight. We can apply them pretty much everywhere," he told AFP. "More or less transparent, the panels also respond to design requirements. Thanks to their flexibility and varying tints, there's no need to add any extra architectural elements." A standard panel of around 1.3 square metres, at a projected cost of 50 euros (\$57), would supply a day's worth of energy to an office workstation, according to current estimates. Malinkiewicz insists that the initial cost of her products will be comparable to conventional solar panels. Perovskite technology is also being tested on a hotel in Japan, near the city of Nagasaki. Plans are also afoot for the pilot production of perovskite panels in Valais, Switzerland and in Germany under the wings of the Oxford Photovoltaics venture. "The potential of the technology is clearly enormous," Assaad Razzouk, the CEO of Singapore-based Sindicatum Rewable Energy, a developer and operator of clean energy projects in Asia, told AFP. "Just think of all the buildings one could retrofit worldwide!"

France 24, 3 February 2019

<http://www.fance24.com>

#### **Invisible tags: Physicists write, read and erase using light**

2019-02-06

Prof. Reineke and his LEXOS team work with simple plastic foils with a thickness of less than 50  $\mu\text{m}$ , which is thinner than a human hair. In these transparent plastic foils, they introduce organic luminescent molecules. In the beginning, these molecules are in an inactive, dark state. By locally using ultraviolet irradiation, it is possible to turn this dark state into an active, luminescent one. By mask illumination or laser writing, activated patterns can be printed onto the foil with a resolution

**A team of physicists has developed a new method of storing information in fully transparent plastic foils.**

## Gossip

### CHEMWATCH

that is comparable to common laser printers. Similar to glow-in-the-dark stickers, the patterns can be brought to shine and the imprinted information can be read. By illuminating with infrared light, the tag is erased completely and new data can be written into it. The working principle of these programmable transparent tags is based on the well-known oxygen molecule. Oxygen is present in the plastic foil and steals the light energy from the glowing molecules. Ultraviolet radiation induces a chemical reaction which efficiently removes the oxygen from the layer. In consequence, the luminescent molecules are activated and are able to emit light. The deactivation process using infrared light is based on a temperature rise of the foil, leading to an increased oxygen permeability and therefore a refilling of the layer with oxygen. These novel tags can be manufactured in any size. The low material costs of less than two euro per square metre promise a wide range of possible applications: Information such as barcodes, serial numbers or addresses can be hidden for on-demand readout only. Also, these invisible tags could propel document security and anti-counterfeiting to a whole new level. Prof. Reineke is already thinking further ahead: 'Those invisible and re-writable tags can be used in a multitude of ways. We can manufacture such tags thinner than conventional barcode stickers. These tags can become a versatile alternative to many frequently technology-laden solutions for information exchange in our daily life. These luminescent tags make electronics obsolete at the location, where the information is stored. The development and optimisation of such systems open a broad research field bringing together material development, process engineering, and fundamental research in an interdisciplinary fashion.

Science Daily, 1 February 2019

<http://www.sciencedaily.com>

### 3D printed tires and shoes that self-repair

2019-02-06

Instead of throwing away your broken boots or cracked toys, why not let them fix themselves? Researchers at the University of Southern California Viterbi School of Engineering have developed 3D-printed rubber materials that can do just that. Assistant Professor Qiming Wang works in the world of 3D printed materials, creating new functions for a variety of purposes, from flexible electronics to sound control. Now, working with Viterbi students Kunhao Yu, An Xin, and Haixu Du, and University of Connecticut Assistant Professor Ying Li, they have made a new material that can be manufactured quickly and is able to repair itself if it becomes fractured

**Instead of throwing away your broken boots or cracked toys, why not let them fix themselves? Researchers have developed 3D-printed rubber materials that can do just that.**

## Gossip

## CHEMWATCH

or punctured. This material could be game-changing for industries like shoes, tires, soft robotics, and even electronics, decreasing manufacturing time while increasing product durability and longevity. The material is manufactured using a 3D printing method that uses photopolymerisation. This process uses light to solidify a liquid resin in a desired shape or geometry. To make it self-healable, they had to dive a little deeper into the chemistry behind the material. Photopolymerisation is achieved through a reaction with a certain chemical group called thiols. By adding an oxidiser to the equation, thiols transform into another group called disulfides. It is the disulfide group that is able to reform when broken, leading to the self-healing ability. Finding the right ratio between these two groups was the key to unlocking the materials' unique properties. "When we gradually increase the oxidant, the self-healing behaviour becomes stronger, but the photopolymerisation behaviour becomes weaker," explained Wang. "There is competition between these two behaviours. And eventually we found the ratio that can enable both high self-healing and relatively rapid photopolymerisation." In just 5 seconds, they can print a 17.5-millimeter square, completing whole objects in around 20 minutes that can repair themselves in just a few hours. In their study, published in NPG Asia Materials, they demonstrate their material's ability on a range of products, including a shoe pad, a soft robot, a multiphase composite, and an electronic sensor. After being cut in half, in just two hours at 60 degrees Celsius (four for the electronics due to the carbon used to transmit electricity) they healed completely, retaining their strength and function. The repair time can be decreased just by raising the temperature. "We actually show that under different temperatures -- from 40 degrees Celsius to 60 degrees Celsius -- the material can heal to almost 100 percent," said Yu, who was first-author of the study and is studying structural engineering. "By changing the temperature, we can manipulate the healing speed, even under room temperature the material can still self-heal" After conquering 3D-printable soft materials, they are now working to develop different self-healable materials along a range of stiffnesses, from the current soft rubber, to rigid hard-plastics. These could be used for vehicle parts, composite materials, and even body armour. This study was published on February 1 and funded by the Air Force Office of Scientific Research Young Investigator Program (FA9550-18-1-0192) and National Science Foundation (CMMI-1762567).

Science Daily, 5 February 2019

<http://www.sciencedaily.com>

### Ferroelectric polymers made more versatile

2019-02-06

The ferroelectric polymer PVDF (polyvinylidene fluoride) has interesting properties and could be used to store information or energy. One of the main drawbacks of PVDF is that if you add extra functional groups to improve certain properties, this also interferes with its ferroelectricity. To solve this, scientists from the University of Groningen have created block copolymers from PVDF that leave its ferroelectricity intact, but allow them to tune its characteristics. They wanted not only to study how this polymer works but also to widen its use to include flexible organic electronics. The results were published in the journal Nature Communications on 6 February. PVDF polymers possess polar structures with dipoles that can be aligned with the application of an electric field. The orientation of the dipoles can be reversed by changing the direction of the electric field. The material thus shows switchable behaviour, which means it could be used for information storage. The presence of dipoles in PVDF and its high dielectric constant means that energy storage in capacitors could also be an option, although its ferroelectricity would reduce the efficiency of such capacitors.

#### Phase separation

Modification of the material might solve this issue. 'However, modifying the molecules by attaching side chains affects their ferroelectric properties', explains Ivan Terzic, a Ph.D. student at the University of Groningen's Department of Polymer Science and co-first author of the Nature Communications paper. Together with his fellow Ph.D. student Niels Meereboer and their supervisor, Professor of Polymer Science Katja Loos, Terzic devised a way to produce a copolymer of vinylidene fluoride and trifluoroethylene with a functionalised end group that can be linked to an insulating polymer chain to form a block copolymer. Next, the scientists showed that the material forms small domains at nanometre scales, through phase separation between the blocks. These domains take different shapes -- lamellar, cylindrical or spherical, for instance -- depending on the ratio between the blocks.

#### Free-standing films

Terzic: 'Others have tried to prepare PVDF block copolymers, but they could only produce blocks with short polymer chains. In that case, the blocks mix and show no phase separation.' By varying the type of block and preparing block copolymers of sufficient length, the scientists were able to tune the properties of the material. An important part of this work

**A toolbox for the production of different PVDF-based block copolymers with tuneable properties**

## Gossip

### CHEMWATCH

was the ability to make free-standing films of the polymer with satisfactory mechanical properties. 'This allowed us to investigate the properties of the material.' Terzic used block copolymers to improve the interactions between PVDF and inorganic nano-objects and to improve their dispersion of inside the polymer. For example, magnetic nanoparticles can be added to the PVDF to produce a multiferroic material that has both ferroelectric and ferromagnetic properties, which means it can be coupled. Furthermore, changing the behaviour of PVDF could make energy retrieval more efficient. 'That would allow us to make a highly efficient capacitor that could be used wherever stored energy needs to be released fast, like in defibrillators or to convert direct current from solar panels to alternating current.'

#### Toolbox

Overall, the authors have created a toolbox for the production of different PVDF-based block copolymers with tunable properties. 'We can use this to increase our understanding of the ferroelectric and other properties of PVDF, but also for new applications,' says Terzic. 'The organic PVDF is flexible, lightweight and non-toxic, in contrast to some inorganic ferroelectrics that often contain lead. And it is bio-compatible, so medical applications are another interesting possibility.'

Science Daily, 5 February 2019

<http://www.sciencedaily.com>

### Researchers use artificial neural networks to streamline materials testing

2019-02-06

Optimising advanced composites for specific end uses can be costly and time consuming, requiring manufacturers to test many samples to arrive at the best formulation. Investigators at the NYU Tandon School of Engineering have designed a machine learning system employing artificial neural networks (ANN) capable of extrapolating from data derived from just one sample, thereby quickly formulating and providing analytics on theoretical graphene-enhanced advanced composites. The work, led by Nikhil Gupta, associate professor of mechanical and aerospace engineering at NYU Tandon, with Ph.D. student Xianbo Xu and collaborators at 2-D graphene materials manufacturer GrapheneCa, is detailed in "Artificial Neural Network Approach to Predict the Elastic Modulus from Dynamic Mechanical Analysis Results," which will be

**Optimising advanced composites for specific end uses can be costly and time consuming, requiring manufacturers to test many samples to arrive at the best formulation.**

## Gossip

### CHEMWATCH

featured on the inside cover of the journal *Advanced Theory and Simulations*. Tensile tests and dynamic mechanical analysis (DMA) are widely used to characterise the viscoelastic properties of materials at different loading rates and temperatures. But this requires an elaborate experimental campaign involving a large number of samples. The Tandon team found a way to by-pass this process by designing an ANN-based approach that builds a model and then feeds it data from DMA—a test of a material's response to a given temperature and loading frequency (a measure of load applied in cycles)—to predict how it will respond to any other temperature and pressure combination. Gupta explained that ANN extrapolated from measures of samples' ability to store and dissipate energy under different conditions. "Testing materials under different conditions during the product development cycle is a major cost for manufacturers who are trying to create composites for numerous applications," noted Gupta. "This system allows us to conduct one test and then predict the properties under other conditions. It therefore considerably reduces the amount of experimentation needed." "Applying an artificial neural network approach to predict the properties of nanocomposites can help in developing an approach where modelling can guide the material and application development and reduce the cost over time," continued Gupta. "Working with the researchers at NYU Tandon's Department of Mechanical and Aerospace Engineering, we have developed a new method for predicting the behaviour of thermosetting nanocomposites over a wide range of temperature and loading rates," said Dr. Sergey Voskresensky, Head of Research & Development at GrapheneCa's New York-based production facility. "Furthermore, the same approach can potentially be applied to predict a behaviour of thermoplastic materials. This is a critical step towards advanced composite production."

Phys.org, 5 February 2019

<http://phys.org>

## Building self-tests for the world's most common infectious diseases—with paper

2019-02-07

When an HIV outbreak hit Indiana's rural Scott County in 2015, the sparsely staffed health department was stretched to confirm cases among an entire community with lab tests that aren't portable and could take weeks to return results. This meant that it took over a year to confirm 235 HIV cases for the area. Even at-home tests for HIV currently require a person to

**Researchers have been harnessing the properties of paper to build faster, cheaper and more portable devices for detecting infectious diseases.**

## Gossip

### CHEMWATCH

wait a couple months after possible infection before testing themselves. What if patients could reliably test themselves at home and know results in minutes, after less than a couple weeks of an infection? A handheld diagnostic tool made out of paper already has that speed and would work not only for HIV, but many other infectious diseases. Using it would be like doing your own pregnancy test. Jacqueline Linnes, an assistant professor of biomedical engineering at Purdue University, has been developing technology with her team that would make lab detection tests both faster and portable, thanks to the inherent properties of paper. The first paper-based device out of Linnes' lab can detect HIV nucleic acids from the blood of a finger prick within 90 minutes. Her lab is working on using the same platform for detecting other diseases, ranging from whooping cough to cholera, since the process of extracting pathogens from a sample using paper would be the same. The device has been designed so far to specifically address challenges with faster disease detection in countries such as Kenya and Haiti, which struggle with affording the costs of running lab facilities, maintaining a constant power supply and training staff to interpret results that are sometimes inaccurate. "In rural areas, a local facility for HIV care can be as far as 10 miles away with poor transport and communication, so many patients on treatment give up and no longer return to health facilities for treatment monitoring," said Eddy Odari, a professor of biomedical research at Jomo Kenyatta University in Kenya, who develops and evaluates diagnostic assays for human pathogenic viruses. "Such patients who don't return have been associated with sub-optimal HIV treatment and increased resistance to first-line antiretroviral therapy, which can lead to a population with transmitted resistance," Odari said. If an affordable and accurate device could run on low enough power to detect diseases on-the-spot for these countries, then it could also prove useful to communities in the U.S. with limited staff and facilities that are far apart. Linnes and her collaborators plan to investigate the device's utility for rural areas of Indiana alongside addressing HIV in Kenya and cholera in Haiti. "The idea is to more quickly detect what's causing an infection for patients both in areas of the world that have the lab facilities close by and those that don't," said Linnes, who specialises in building point-of-care diagnostic tools for the field. For the past 30 years, researchers have been investigating paper-based devices for faster diagnostics because paper-like materials, such as glass fibre and cellulose, are robust and known to function as a pump. This means that paper can carry samples, such as blood or water, without all the external equipment required within a lab to separate out the nucleic acids of a pathogen and make copies, or "amplify" them, for detection. "Paper" is a broad term for a porous material that can pull liquid along, not just the

## Gossip

### CHEMWATCH

type that you can write on. Band-aid pads are paper-like, for example," Linnes said. "The downside is that paper doesn't have any controls." For this reason, most paper-based devices relying on nucleic acid amplification are still in very early stages. Linnes' lab has been working to speed up how these devices operate in the field by reducing the number of steps needed to separate pathogens from a sample loaded onto paper. So far, Linnes' lab and other researchers at Purdue have reduced these steps through an electronic circuit board that heats wax valves from beneath intricate channels of paper, controlling the flow of a sample in one step rather than multiple steps. The process starts with adding buffer liquid to a finger prick of blood within a vial, and then pouring the vial into a hole within the paper. If a band shows up on the end of the paper strip after a sample has been loaded, in addition to the control band, then a person has tested positive for a disease. Because reading a paper strip is easy and low cost, there wouldn't really be a need for the technology to go digital. But Linnes and her collaborators have been working on another problem that calls for a digital solution: knowing how well a person is responding to treatment for an infectious disease. Through a company that Linnes co-founded, OmniVis, Purdue researchers are investigating the use of smartphone technology to quantify HIV in the body. "If you're on antiretroviral drugs and your body is responding well, then the amount of virus would be low, but if you're resistant to the drugs, then the amount of virus would increase," Linnes said. Patents for the paper-based device have been filed through the Purdue Research Foundation Office of Technology Commercialization.

Phys.org, 5 February 2019

<http://phys.org>

## Observing hydrogen's effects in metal

2019-02-07

Hydrogen, the second-tiniest of all atoms, can penetrate right into the crystal structure of a solid metal. That's good news for efforts to store hydrogen fuel safely within the metal itself, but it's bad news for structures such as the pressure vessels in nuclear plants, where hydrogen uptake eventually makes the vessel's metal walls more brittle, which can lead to failure. But this embrittlement process is difficult to observe because hydrogen atoms diffuse very fast, even inside the solid metal. Now, researchers at MIT have figured out a way around that problem, creating a new technique that allows the observation of a metal surface during hydrogen penetration. Their findings are described in a paper appearing

**Microscopy technique could help researchers design safer reactor vessels or hydrogen storage tanks**

## Gossip

### CHEMWATCH

in the International Journal of Hydrogen Energy, by MIT postdoc Jinwoo Kim and Thomas B. King Assistant Professor of Metallurgy C. Cem Tasan. Hydrogen fuel is considered a potentially major tool for limiting global climate change because it is a high-energy fuel that could eventually be used in cars and planes. However, expensive and heavy high-pressure tanks are needed to contain it. Storing the fuel in the crystal lattice of the metal itself could be cheaper, lighter, and safer -- but first the process of how hydrogen enters and leaves the metal must be better understood. "Hydrogen can diffuse at relatively high rates in the metal, because it's so small," Tasan says. "If you take a metal and put it in a hydrogen-rich environment, it will uptake the hydrogen, and this causes hydrogen embrittlement," he says. That's because the hydrogen atoms tend to segregate in certain parts of the metal crystal lattice, weakening its chemical bonds. The new way of observing the embrittlement process as it happens may help to reveal how the embrittlement gets triggered, and it may suggest ways of slowing the process -- or of avoiding it by designing alloys that are less vulnerable to embrittlement. The key to the new monitoring process was devising a way of exposing metal surfaces to a hydrogen environment while inside the vacuum chamber of a scanning electron microscope (SEM). Because the SEM requires a vacuum for its operation, hydrogen gas cannot be charged into the metal inside the instrument, and if precharged, the gas diffuses out quickly. Instead, the researchers used a liquid electrolyte that could be contained in a well-sealed chamber, where it is exposed to the underside of a thin sheet of metal. The top of the metal is exposed to the SEM electron beam, which can then probe the structure of the metal and observe the effects of the hydrogen atoms migrating into it. The hydrogen from the electrolyte "diffuses all the way through to the top" of the metal, where its effects can be seen, Tasan says. The basic design of this contained system could also be used in other kinds of vacuum-based instruments to detect other properties. "It's a unique setup. As far as we know, the only one in the world that can realise something like this," he says. In their initial tests of three different metals -- two different kinds of stainless steel and a titanium alloy -- the researchers have already made some new findings. For example, they observed the formation and growth process of a nanoscale hydride phase in the most commonly used titanium alloy, at room temperature and in real time. Devising a leakproof system was crucial to making the process work. The electrolyte needed to charge the metal with hydrogen, "is a bit dangerous for the microscope," Tasan says. "If the sample fails and the electrolyte is released into the microscope chamber," it could penetrate far into every nook and cranny of the device and be difficult to clean out. When the time came to carry out their first experiment in the

## Gossip

## CHEMWATCH

specialised and expensive equipment, he says, “we were excited, but also really nervous. It was unlikely that failure was going to take place, but there’s always that fear.”

EurekAlert, 5 February 2019

<http://www.eurekalert.org>

### Rust never sleeps

2019-02-07

Like iron flowing through the blood stream, iron minerals course through the ground. These minerals are used to make steel and other metal alloys used in everything from cell phone components and cars to buildings, industrial equipment and infrastructure. Unfortunately, when exposed to oxygen and moisture, iron oxidises--or rusts. And rust is relentless. Knowing more about the chemical reactions that drive and sustain rust could hold clues for engineering-improved, iron-based materials. It could also lead to advances in fertilisers or soil conditioners that increase iron uptake for plant nutrition. Scientists at the Department of Energy’s Pacific Northwest National Laboratory report in the journal PNAS a breakthrough in visualising the reactivity of rust minerals when deprived of oxygen, such as those below the soil surface. Using iron isotopes and atom probe tomography, or APT, they traced these oxidation-reduction reactions to create the first 3D “atomic maps” of the re-arrangement of different iron atoms in a small iron oxide crystal. The APT maps revealed a surprisingly dynamic iron cycle, showing the continual movement of iron on and off the mineral surfaces. “We saw that iron atoms in water specifically sought out and filled in tiny potholes, or defects, in the crystal surfaces,” said Sandra Taylor, a post-doctoral research associate in PNNL’s Geochemistry Group who conducted the measurements. “Seeing these recrystallised regions at the atomic scale showed us that the reaction can effectively ‘heal’ damaged areas on the crystal surface, and growth is driven by perfection.” Kevin Rosso, a PNNL Laboratory Fellow and lead investigator for the study, says the results confirm that reactions with rust minerals in soils and steel corrosion products are more dynamic than typically thought. They illustrate how rust persists on metal pipes under changing chemical conditions, enabling it to continually corrode and deteriorate over time. The discovery capped a years-long effort to capture chemical composition measurements and images at the atomic scale in 3D using APT. This sophisticated and challenging technique requires great skill to successfully probe the surfaces of nanoparticle iron oxides. The atom probe is located in the Environmental Molecular Sciences Laboratory,

**PNNL research using atom probe tomography reveals chinks in iron crystals that can ‘heal’**

## Gossip

## CHEMWATCH

a DOE Office of Science user facility at PNNL. "This study sets a new precedent for characterising this important redox interface," said Rosso, adding that the results can be used to better understand a broad range of processes. These include understanding how crystals grow and dissolve, and also the underlying causes of corrosion and how it creates rust on surfaces--rust that never sleeps.

EurekAlert, 4 February 2019

<http://www.eurekalert.org>

### Lettuce show you how to restore oil-soaked soil

2019-02-07

Rice University engineers have figured out how soil contaminated by heavy oil can not only be cleaned but made fertile again. How do they know it works? They grew lettuce. Rice engineers Kyriacos Zygourakis and Pedro Alvarez and their colleagues have fine-tuned their method to remove petroleum contaminants from soil through the age-old process of pyrolysis. The technique gently heats soil while keeping oxygen out, which avoids the damage usually done to fertile soil when burning hydrocarbons cause temperature spikes. While large-volume marine spills get most of the attention, 98 percent of oil spills occur on land, Alvarez points out, with more than 25,000 spills a year reported to the Environmental Protection Agency. That makes the need for cost-effective remediation clear, he said. "We saw an opportunity to convert a liability, contaminated soil, into a commodity, fertile soil," Alvarez said. The key to retaining fertility is to preserve the soil's essential clays, Zygourakis said. "Clays retain water, and if you raise the temperature too high, you basically destroy them," he said. "If you exceed 500 degrees Celsius (900 degrees Fahrenheit), dehydration is irreversible." The researchers put soil samples from Hearne, Texas, contaminated in the lab with heavy crude, into a kiln to see what temperature best eliminated the most oil, and how long it took. Their results showed heating samples in the rotating drum at 420 C (788 F) for 15 minutes eliminated 99.9 percent of total petroleum hydrocarbons (TPH) and 94.5 percent of polycyclic aromatic hydrocarbons (PAH), leaving the treated soils with roughly the same pollutant levels found in natural, uncontaminated soil. The paper appears in the American Chemical Society journal Environmental Science and Technology. It follows several papers by the same group that detailed the mechanism by which pyrolysis removes contaminants and turns some of the unwanted hydrocarbons into char, while leaving behind soil almost as fertile as the original. "While heating soil to clean it isn't

**Engineers have fine-tuned a method to restore oil-soaked soil to fertility while eliminating toxic hydrocarbons.**

## Gossip

### CHEMWATCH

a new process," Zygourakis said, "we've proved we can do it quickly in a continuous reactor to remove TPH, and we've learned how to optimise the pyrolysis conditions to maximise contaminant removal while minimising soil damage and loss of fertility. "We also learned we can do it with less energy than other methods, and we have detoxified the soil so that we can safely put it back," he said. Heating the soil to about 420 C represents the sweet spot for treatment, Zygourakis said. Heating it to 470 C (878 F) did a marginally better job in removing contaminants, but used more energy and, more importantly, decreased the soil's fertility to the degree that it could not be reused. "Between 200 and 300 C (392-572 F), the light volatile compounds evaporate," he said. "When you get to 350 to 400 C (662-752 F), you start breaking first the heteroatom bonds, and then carbon-carbon and carbon-hydrogen bonds triggering a sequence of radical reactions that convert heavier hydrocarbons to stable, low-reactivity char." The true test of the pilot program came when the researchers grew Simpson black-seeded lettuce, a variety for which petroleum is highly toxic, on the original clean soil, some contaminated soil and several pyrolyzed soils. While plants in the treated soils were a bit slower to start, they found that after 21 days, plants grown in pyrolyzed soil with fertiliser or simply water showed the same germination rates and had the same weight as those grown in clean soil. "We knew we had a process that effectively cleans up oil-contaminated soil and restores its fertility," Zygourakis said. "But, had we truly detoxified the soil?" To answer this final question, the Rice team turned to Bhagavatula Moorthy, a professor of neonatology at Baylor College of Medicine, who studies the effects of airborne contaminants on neonatal development. Moorthy and his lab found that extracts taken from oil-contaminated soils were toxic to human lung cells, while exposing the same cell lines to extracts from treated soils had no adverse effects. The study eased concerns that pyrolyzed soil could release airborne dust particles laced with highly toxic pollutants like PAHs. "One important lesson we learned is that different treatment objectives for regulatory compliance, detoxification and soil-fertility restoration need not be mutually exclusive and can be simultaneously achieved," Alvarez said. Wen Song, a visiting scholar at Rice and a student at the University of Jinan and Shandong University, China, is lead author of the paper. Co-authors are Rice alumna Julia Vidonish of Arcadis U.S., Seattle; Rice postdoctoral researcher Pingfeng Yu; Roopa Kamath, an environmental adviser at Chevron; Chun Chu, a research associate at Baylor College of Medicine; and Baoyu Gao, a professor of environmental engineering at Shandong University. Alvarez is the George R. Brown Professor of Materials Science and NanoEngineering and a professor of civil and environmental engineering at Rice. Zygourakis is the A.J. Hartsook Professor of Chemical

## Gossip

## CHEMWATCH

and Biomolecular Engineering and a professor of bioengineering. The research was supported by Chevron U.S.A., the National Natural Science Foundation of China, the Shanghai Tongji Gao Tingyao Environmental Science and Technology Development Foundation, the Taishan Scholar Program and the National Institutes of Health.

Science Daily, 5 February 2019

<http://www.sciencedaily.com>

### Researchers synthesise renewable oils for use in lubricants

2019-02-07

Engine gears, plane thrusters, refrigerator compressors, wind turbines—the list of important industrial machinery, agricultural equipment, transportation vessels, and home applications that depend on lubricants might be endless. These slick substances quite literally keep the world turning, touching nearly every facet of modern life and comprising a global industry worth more than \$60 billion dollars annually. And yet, as essential as they are to our way of life, lubricants leave a heavy environmental footprint. Common lubricants, oils, greases and emollients typically consist of mineral, or petroleum, base oils—often up to 90 percent by weight. These mineral base oils are highly volatile and tend to thicken quickly, which means that lubricants need to be replaced often, generating waste. Synthetic base oils are key to efficient lubricants—owing to their better lubrication properties, stability, and suitability for extreme temperatures compared to their regular mineral-base oils counterparts—but producing them with tunable (i.e. customisable) structures and specifications can be both challenging and expensive. This lack of tunability creates a need for mixing the base-oil with several expensive additives, increasing the environmental footprint of lubricants. Now, researchers at the University of Delaware-led Catalysis Centre for Energy Innovation (CCEI) and investigators from its partner institutions are working to solve these problems. Their findings report a strategy to create renewable lubricant base oils efficiently from non-food biomass—things like wood, switchgrass and other sustainable, organic waste—and fatty acids, which are present in used vegetable oils and animal fat. The group's research has been published in the latest issue of Science Advances, and an international patent application has been filed to secure intellectual property rights for their innovative methods. "This is one of the first attempts to make renewable lubricants from abundant raw materials, and in a very precise chemical way so that the architecture of

## Gossip

## CHEMWATCH

these large molecules is dialled in, something unachievable using crude oil," said Dion Vlachos, founder and director of CCEI and the Allan and Myra Ferguson Professor of Chemical and Biomolecular Engineering. "The product is clearly a high-performance material with tunable properties, unlike anything in the market." Basu Saha, associate director at CCEI, points to catalysis as the key to synthesising these new base-oils. "Catalysts are used to accelerate chemical reactions and create new materials," Saha said. "For lubricants, catalysis allows researchers to not only synthesise new and existing structurally similar base-oils from bio-based feedstock, but lends extensive control over the molecules' weight, size distribution, branching and specifications." Produced base oils are suitable for a wide range of existing applications without requiring high amounts of additives in the lubricant formulation, said Sibao Liu, a postdoctoral researcher at UD and one of the paper's co-authors. "We've provided a new, efficient and versatile catalytic reaction pathway for synthesis of renewable lubricants with tunable properties," Liu adds. "We hope this could eventually displace the manufacturing process for some lubricants used today and minimize environmental carbon footprint, though there is still a long way to go."

Phys.org, 4 February 2019

<http://phys.org>

### Simply shining light on dinosaur metal compound kills cancer cells

2019-02-07

A new compound based on Iridium, a rare metal which landed in the Gulf of Mexico 66 M years ago, hooked onto albumin, a protein in blood, can attack the nucleus of cancerous cells when switched on by light, University of Warwick researchers have found. The treatment of cancer using light, called Photodynamic therapy, is based on chemical compounds called photosensitisers, which can be switched on by light to produce oxidising species, able to kill cancer cells. Clinicians can activate these compounds selectively where the tumour is (using optical fibres) thus killing cancer cells and leaving healthy cells intact. Thanks to the special chemical coating they used, the Warwick group was able to hook up Iridium to the blood protein Albumin, which then glowed very brightly so they could track its passage into cancer cells, where it converted the cells' own oxygen to a lethal form which killed them. Not only is the newly formed molecule an excellent photosensitiser, but Albumin is able to deliver it into the nucleus inside cancer cells. The dormant compound can then be switched on by light irradiation and destroy the cancer cells from their very centre.

**A new compound based on Iridium, a rare metal which landed in the Gulf of Mexico 66 M years ago, hooked onto albumin, a protein in blood, can attack the nucleus of cancerous cells when switched on by light, University of Warwick researchers have found.**

## Gossip

## CHEMWATCH

The bright luminescence of the iridium photosensitiser allowed its accumulation in the nucleus of tumour cells and its activation leading to the cancer cell death to be followed in real time using a microscope. Professor Peter Sadler, from the Department of Chemistry at the University of Warwick comments: "It is amazing that this large protein can penetrate into cancer cells and deliver iridium which can kill them selectively on activation with visible light. If this technology can be translated into the clinic, it might be effective against resistant cancers and reduce the side effects of chemotherapy".

Dr. Cinzia Imberti, from the University of Warwick comments: "It is fascinating how albumin can deliver our photosensitiser so specifically to the nucleus. We are at a very early stage, but we are looking forward to see where the preclinical development of this new compound can lead." "Our team is not only extremely multidisciplinary, including biologists, chemists and pharmacists, but also highly international, including young researchers from China, India and Italy supported by Royal Society Newton and Sir Henry Wellcome Fellowships." The paper 'Nucleus Targeted Organoiridium-Albumin Conjugate for Photodynamic Cancer Therapy' has been published in *Angewandte Chemie International Edition*.

Phys.org, 4 February 2019

<http://phys.org>

### Research shows hidden fire risk of emollients

2019-02-07

New research carried out by forensic scientists at Anglia Ruskin University has shown that commonly-used emollients can pose a significant fire risk once they have dried on fabric such as clothing and bedding. The scientists tested a variety of emollients, some of which are commonly used for treating skin conditions such as eczema and psoriasis. The findings have been published in the *Fire Safety Journal* and were presented at the UK Association of Fire Investigators conference in Leeds recently. Initial work focused on creams, lotions and ointments with a paraffin base, but their recent laboratory research has indicated that the presence of paraffin-free emollient increases the flammability of fabrics. Dr Sarah Hall and Joanne Morrissey of Anglia Ruskin University measured the time it takes for fabrics - including cotton of different thread counts and polyester-cotton blend - to ignite once contaminated with an emollient and in close proximity of a naked flame. Non-contaminated fabrics took an average of 65 seconds to ignite, while those containing emollient residue, from both paraffin and

**New research carried out by forensic scientists at Anglia Ruskin University has shown that commonly-used emollients can pose a significant fire risk once they have dried on fabric such as clothing and bedding.**

## Gossip

### CHEMWATCH

paraffin-free creams, caught fire in less than 20 seconds. Dr Hall, Senior Lecturer in Forensic Science at Anglia Ruskin University, said: "We were driven to carry out this work following a couple of tragic cases reported to us by Essex Fire and Rescue Service that were linked to fires and the use of emollients. Since then we have worked jointly with Essex Fire and Rescue, London Fire Brigade and West Yorkshire Fire and Rescue Service. "Our initial research focused on the range of paraffin-based creams, as this seemed the most obvious reason for flammability. However, we are now seeing that fabric that has been in contaminated with any of these creams reacts in a similar way. "We are now carrying out further research to try and identify any common ingredients as well as the best ways of removing the residue from clothing and bedding, for example the ideal washing temperature." Watch Manager Chris Bell, West Yorkshire Fire and Rescue Service and National Fire Chiefs Council Emollient Lead, said: "We welcome the report from Anglia Ruskin University and we thank the researchers for their commitment to exploring this issue further. "We want to reassure people that emollients are safe to use. They are an effective treatment for skin conditions so people should continue to use them. "However, people should be aware that when using emollients, they can come into contact with fabrics, clothing, bedding or bandages which then dries leaving a flammable residue. The fabric can then be easily ignited with smoking materials such as matches and lighters, naked flames or other heat sources. "We are asking people who prescribe, dispense or apply these products to be aware that switching to a lower or paraffin-free emollient will not reduce the fire risk. Washing fabrics will reduce the risk but may not totally remove it."

The emollient products such as creams, sprays, liquids or gels are safe to use and vital for skin conditions that they treat. The danger exists when residue of the products gets onto fabrics, bedding, clothing and bandages. This dried residue will make the fabric more flammable. The risk of paraffin-free emollient products should not be excluded as initial tests indicate the risk is similar to paraffin-based emollients. It is recommended those that prescribe, dispense and apply these products should speak to the patients and tell them about the fire risks. Prescribers who have switched patients to a lower paraffin product or a paraffin-free alternative should be aware that this will not reduce the risk. People using products should not go near to naked flames, smoking materials, cookers and heaters. Keep away from anyone else that is smoking if there is any risk of fabric contamination. Washing fabrics at the highest temperature recommended on the fabric care label will reduce the emollient residue

## Gossip

### CHEMWATCH

but may not totally remove it. Therefore, remain cautious and stay away from fire.

EurekaAlert, 4 February 2019

<http://www.eurekaalert.org>

## Curiosities

### CHEMWATCH

#### **Fish oil does not appear to improve asthma control in teens, young adults**

2019-02-07

Fish oil does not appear to improve asthma control in adolescents and young adults with uncontrolled asthma who are overweight or obese, according to new research published online in the *Annals of the American Thoracic Society*. In "Fish Oil Supplementation in Overweight/Obese Patients with Uncontrolled Asthma: A Randomised Trial," Jason E. Lang, MD, MPH, and co-authors report that four grams of fish oil a day for six months did not improve asthma control, as measured by a standard asthma control questionnaire, breathing tests, urgent care visits and severe asthma exacerbations. "We don't know why asthma control in obese patients is more difficult, but there is growing evidence that obesity causes systemic inflammation," said Dr. Lang, lead study author and associate professor of paediatrics at Duke University. "Because the omega-3 fatty acids in fish oil have anti-inflammatory properties, we wanted to test whether fish oil would have therapeutic benefits for these patients." The 98 overweight/obese participants in the study ranged in age from 12 to 25 (average age: 14.6). All were diagnosed with asthma by a physician but had poor asthma control, despite using a daily inhaled corticosteroid to control their asthma. About half the participants were African American. For every three participants assigned to take fish oil for 25 weeks, one was assigned to take the soy oil placebo. The researchers also looked at whether a variant in the gene *ALOX5* affected study findings. It is known that mutations in the gene can reduce responses to anti-leukotriene drugs. Leukotrienes are inflammatory molecules that play a critical role in triggering asthma attacks. In this study, the *ALOX5* variant did appear to be linked to leukotriene production but not to the effectiveness of fish oil in providing asthma control. The authors wrote that the study's negative findings may not be the last word on fish oil and asthma. They acknowledged that larger doses of fish oil over a longer period of time may produce a different result. Based on the current study, however, "there is insufficient evidence for clinicians to suggest to patients with uncontrolled asthma that they should take daily fish oil supplements to help their asthma," Dr. Lang said.

EurekAlert, 25 January 2019

<http://www.eurekalert.org>

**Fish oil does not appear to improve asthma control in adolescents and young adults with uncontrolled asthma who are overweight or obese, according to new research published online in the *Annals of the American Thoracic Society*.**

## Curiosities

### CHEMWATCH

#### **Yes please to yogurt and cheese: The new improved Mediterranean diet**

2019-02-07

Thousands of people can take heart as new research from the University of South Australia shows a dairy-enhanced Mediterranean diet will significantly increase health outcomes for those at risk of cardiovascular disease - and it's even more effective than a low-fat diet. Cardiovascular disease takes the lives of 17.9 million people every year, representing 31 per cent of all global deaths. In Australia, it is the single leading cause of death in Australia, affecting 4.2 million Australians and killing one Australian every 12 minutes. Low-fat diets are often recommended as suitable food plans for those seeking to reduce their risk factors for cardiovascular disease. Similarly, the Mediterranean diet (MedDiet) has been shown to deliver significant health benefits. In this UniSA study, published by the American Journal of Clinical Nutrition, researchers compared the health benefits of a MedDiet supplemented with two to three serves of dairy each day, and a generic low-fat diet. The results show that the dairy-supplemented MedDiet (MedDairy) significantly improved blood pressure, heart rate, cholesterol, mood and cognitive function. PhD candidate Alexandra Wade says the new MedDairy diet challenges popular perceptions of what is considered healthy. "The MedDiet is fast earning a reputation as the world's healthiest diet and is renowned for delivering improved cardiovascular and cognitive health," Wade says. "But it's also higher in fat, which can be a deterrent for people seeking to adopt a healthier eating plan, especially if they don't realise the difference between healthy and unhealthy fats." "In Australia, low-fat diets are often recommended for improving heart health and they are still perceived as being healthy." "This study shows that the new MedDairy works better than a generic low-fat diet, ensuring better health outcomes for people at risk of cardiovascular disease." "Importantly, the MedDairy diet also meets additional calcium requirements recommended by Australia's national health bodies. A typical MedDiet includes extra virgin olive oil, fruits, vegetables, nuts, seeds, legumes, wholegrain breads, pastas and cereals, moderate consumption of fish and red wine, and low consumption of red meat, sweet and processed foods. It also includes 1-2 servings of dairy foods (700-820mg calcium), which is less than half the dairy recommended by the Australian National Health and Medical Research Council (NHMRC) for older Australians. "Living in Australia, we have different dietary requirements, notably a need for more calcium to protect against osteoporosis," Wade says. "These needs are unmet in the traditional MedDiet, which makes it difficult for people to adopt in the

**Thousands of people can take heart as new research from the University of South Australia shows a dairy-enhanced Mediterranean diet will significantly increase health outcomes for those at risk of cardiovascular disease - and it's even more effective than a low-fat diet.**

## Curiosities

### CHEMWATCH

long term. "This study delivers healthier options for Australians by tailoring the nutrients in the MedDiet to meet the needs of a non-Mediterranean population. "In Australia, women up to age 50 years - and men up to age 70 years - should consume 1000mg per day of calcium per day and 1300mg thereafter, which is roughly between 3.5 and 4.5 serves a day. "The new MedDairy diet allows for three to four servings with dairy, which means Australians can more sustainably meet their recommended daily nutrient intakes while also maintaining the significant health benefits offered through the MedDiet. "When it comes down to it, people want to be able to enjoy a colourful, tasty and nutritious diet. And if you're one of the thousands of people seeking to improve your cardiovascular and cognitive health - look no further than the MedDairy diet."

EurekaAlert, 24 January 2019

<http://www.eurekaalert.org>

### **New study offers 'strongest evidence' yet that exercise helps prevent depression**

2019-02-07

Does physical activity reduce depression, or does depression reduce physical activity? It's a quintessential chicken and egg scenario — and a question that's plagued scientists for some time. Now, thanks to the power of modern genomics, a new study published in JAMA Psychiatry provides the "strongest evidence" yet that exercise has a protective effect against depression. Using the genetic data of 300,000 adults, researchers at Massachusetts General Hospital found people with higher levels of physical activity had lower odds of major depressive disorder, according to lead researcher Karmel Choi. "We found evidence that higher levels of physical activity may causally reduce risk for depression," Dr Choi said. In fact, the research shows that replacing sedentary behaviour with 15 minutes of vigorous activity each day can reduce depression risk by roughly 26 per cent. "On average, doing more physical activity appears to protect against developing depression ... and any activity appears to be better than none." While the study showed physical activity could prevent depression, it found no evidence that being diagnosed with depression affected a person's ability to exercise.

#### What's the minimum exercise you need to stay healthy?

If your goals include staying healthy and maintaining your fitness, you might be wondering: how much exercise do you really need to do each

**Many people feel a lift in their mood after exercising — now researchers have been able to measure the effect.**

## Curiosities

### CHEMWATCH

week? But people diagnosed with depression are still at an increased risk of reduced physical activity, according to Joseph Firth, a senior research fellow at Western Sydney University who was not involved in the study. "It's still the case that people with depression are less active than the general population, but [the study] is saying it's not necessarily the depression itself that's driving that relationship," Dr Firth said. "It could be social factors, rather than the actual genetics of depression. "So, it's still worth thinking about physical activity interventions for people with depression."

#### Using exercise as prevention

Dr Firth said the study provided "the strongest evidence" to date for using exercise as a potential strategy to reduce the risk of depression across the general population. "Depression is generally regarded as an epidemic, particularly across Western societies — many countries are struggling with high rates of it," he said. "These findings could ultimately inform new public health schemes, which use physical activity and exercise to not only reduce the risk of physical health problems, but also to combat the mental health epidemic." Dr Choi said it was one thing to know that physical activity could be beneficial for preventing depression, and another to actually get people to be physically active. "More work needs to be done to figure out how best to tailor recommendations to different kinds of people with different risk profiles," she said. "We currently are looking at whether and how much physical activity can benefit different at-risk groups, such as people who are genetically vulnerable to depression or those going through stressful situations. "[We] hope to develop a better understanding of physical activity to promote resilience to depression."

#### Using a genetic framework

For years, research has demonstrated an association between increased physical activity and a reduced risk of depression. However, until now it has been difficult to establish a clear "cause and effect" relationship, and to conclusively rule out other confounding variables. So, researchers turned to their attention to genetics — since our genes are randomly assigned to us before birth, and (largely) independent of environmental and social factors. The team looked at people who carry genetic variants associated with increased physical activity, and whether these variants impacted their risk of depression. Their reasoning was that, if exercise does reduce the incidence of depression, then people carrying gene variants that predispose them to exercise should proportionally be less likely to get depressed. "If A causes B in the real world, any factor that influences A should also influence B in a similar way," Dr Choi said. And that was exactly

## Curiosities

### CHEMWATCH

what researchers found: higher levels of physical activity (objectively measured, and indicated by associated gene variants) were linked to lower levels of depression. The findings were not replicated when people self-reported physical activity, suggesting people may not be good at accurately reporting their true levels of exercise. "Knowing whether an associated factor actually causes an outcome is important, because we want to invest in preventive strategies that really work," Dr Choi said.

#### It's not a two-way street

To work out whether the relationship between exercise and depression goes both ways, researchers also looked at whether genetic variants that predispose people to depression were associated with changes in rates of physical activity. Researchers found this was not the case — there was no evidence to support the idea that depression itself reduces rates of exercise. "We did not see such a pattern in the genetic data, regardless of how physical activity was measured," Dr Choi said. Alex Parker, a professor of physical activity and mental health at Victoria University, said the study's finding that replacing sedentary behaviour with movement could reduce depression risk was in line with previous research. "There's definitely some similarity between what the authors proposed in this study as conferring a proactive effect ... with what we know from the bulk of the studies that have looked at exercise for treating depression," Professor Parker said. "There seems to be a fair way to go in terms of being certain about the dose of exercise required for anti-depressant effects. "But there is a suggestion that to get mental health benefits from engaging in physical activity — the dose of activity might be less than it is to get a physical health benefit."

ABC Health, 25 January 2019

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

## Not All Insomnia Is The Same — In Fact, There May Be 5 Types

2019-02-07

Rather than just considering sleep-related symptoms, a new study from the Netherlands branches out to look at personality traits and emotions, and finds there are five types of insomnia. The findings may pave the way for a better understanding of the causes of insomnia, as well as the development of more personalized treatments for the condition, the researchers said. The study, conducted by researchers at the Netherlands

**Rather than just considering sleep-related symptoms, a new study from the Netherlands branches out to look at personality traits and emotions, and finds there are five types of insomnia.**

## Curiosities

### CHEMWATCH

Institute for Neuroscience in Amsterdam, was published online Jan. 7 in the journal *The Lancet Psychiatry*.

#### Five types

Insomnia affects an estimated 10 percent of the population. The main symptoms involve difficulty falling or staying asleep — for example, people with the condition may lie awake for long periods before being able to fall asleep, or they may wake up too early and not be able to fall back to sleep, according to the National Institutes of Health. But despite having similar symptoms, people with insomnia can vary widely in their response to treatment. In addition, attempts to find “biomarkers” for the condition — like commonalities in people’s brain scans — have proved futile, the researchers said. These inconsistencies suggest that there may be more than one type of insomnia. In an effort to find “subtypes” of insomnia, the researchers analysed information from more than 4,000 people who filled out online surveys about their sleep habits and other traits as part of a project called the Netherlands Sleep Registry. Based on their survey responses, about 2,000 of these participants had insomnia. (These participants scored high on an insomnia-related survey, but did not have a confirmed diagnosis.) To identify subtypes, the researchers went beyond looking at sleep-related symptoms and considered other factors, including personality traits, mood, emotions and response to stressful life events. The study authors found that participants with insomnia tended to fit into one of five categories:

- Type 1: People with type 1 insomnia tended to have high levels of distress (meaning high levels of negative emotions like anxiety and worry) and low levels of happiness.
- Type 2: People with type 2 insomnia had moderate levels of distress, but their levels of happiness and experiences of pleasurable emotions tended to be relatively normal.
- Type 3: People with type 3 insomnia also had moderate levels of distress, but had low levels of happiness and reduced experiences of pleasure.
- Type 4: People with type 4 insomnia typically had low levels of distress, but they tended to experience long-lasting insomnia in response to a stressful life event.
- Type 5: People with type 5 insomnia also had low levels of distress, and their sleep disorder wasn’t affected by stressful life events.

## Curiosities

### CHEMWATCH

These subtypes were consistent over time: When participants were surveyed again five years later, most of them maintained the same subtype.

#### Personalised treatment?

The researchers also found that people with different insomnia subtypes differed in terms of their response to treatment and their risk of depression. For example, people with subtypes 2 and 4 saw the most improvement in their sleep symptoms after taking a benzodiazepine (a type of tranquiliser), while people with type 3 did not see improvement from this type of drug. In addition, people with subtype 2 responded well to a type of talk therapy called cognitive behavioural therapy, while people with subtype 4 did not. People with subtype 1 had the greatest lifetime risk of depression. The findings suggest that certain insomnia treatments may work best for certain subtypes, and future research should examine this. In addition, identifying people with insomnia who are at greatest risk of depression may lead to ways to help prevent depression in this group, the researchers said. In an editorial accompanying the study, Tsuyoshi Kitajima, of the Department of Psychiatry at Fujita Health University School of Medicine in Japan, said the work shows that “robust subtyping is possible” among a group of people with insomnia. However, Kitajima said some sleep doctors may have concerns about these subtypes because they are largely based on factors that aren’t directly related to sleep. But, Kitajima noted that some of the subtypes described in the new study bear similarities to previously accepted (though now abandoned) categories of insomnia. For example, people with subtypes 1 and 2 tended to develop symptoms early in life — in childhood or adolescence. This is similar to symptoms seen in people with so-called “idiopathic insomnia,” a traditional category of insomnia in which people develop the condition early in life without an identifiable cause. (However, idiopathic insomnia is no longer listed as a type of insomnia in the diagnostic manual known as the International Classification of Sleep Disorders, Third Edition). Kitajima added that it would be beneficial to confirm the findings in people who have actually been diagnosed with insomnia. The study authors also noted that participants volunteered to take part in a sleep-related study, and this group may not necessarily be representative of the population as a whole. There could also be additional subtypes that have yet to be identified.

Live Science, 17 January 2019

<http://www.livescience.com>

## Curiosities

### CHEMWATCH

### Increasing temperatures from climate change may harm babies' hearts

2019-02-07

Increasing temperatures from climate change could drive up the number of babies born with congenital heart defects, warns a new study from the Journal of the American Heart Association. The report warns that heat exposure for mothers across the U.S. is set to rise. Previous research has found a link between pregnant women's heat exposure and congenital heart defects in their babies. Congenital heart defects affect about 40,000 babies in the U.S. annually, according to the U.S. Centers for Disease Control and Prevention. The researchers estimated the number of births to take place from 2025 to 2035 and the expected increase in maternal heat exposure as a result of warming temperatures, which meant looking at the number of excessively hot days and the frequency of extreme heat days. They found the greatest projected increases in the number of babies born with heart defects in the Midwest, followed by the Northeast and the South. In eight states—Arkansas, Texas, California, Iowa, North Carolina, Georgia, New York and Utah—the researchers projected an additional 7,000 cases of congenital heart defects over the 11 years studied. "Our results highlight the dramatic ways in which climate change can affect human health and suggest that paediatric heart disease stemming from structural heart malformations may become an important consequence of rising temperatures," said lead author Dr. Wangjian Zhang, a post-doctoral research fellow at the University of Albany, in a statement. Dr. Shao Lin, a co-author and associate director of environmental health services at the University at Albany, State University of New York, said in a statement the report highlights the importance of doctors telling pregnant women to avoid extreme heat. She added that three to eight weeks after conception is the "critical period of pregnancy." It's not entirely clear why maternal heat exposure spurs more heart defects in babies. Animal studies probing the link have found that the heat may kill some crucial foetal cells or interfere with heat-sensitive proteins that are vital for the babies' development. "Although this study is preliminary, it would be prudent for women in the early weeks of pregnancy to avoid heat extremes similar to the advice given to persons with cardiovascular and pulmonary disease during heart spells," Lin said. A copy of the [full report](#) is available here.

**New report finds a rise in maternal heat exposure could mean more congenital heart disease for US babies over the next decade**

Environmental Health News, 30 January 2019

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

## Curiosities

### CHEMWATCH

#### **Desalination plants are on the rise—so is their salty, chemical waste**

2019-02-07

The rise of desalination plants, now almost 16,000 worldwide, has led to a glut of brine waste—much of which is dumped into oceans, which can raise salinity to dangerous levels and put toxic chemicals in the marine environment threatening ocean life, according to a new study. The study is the first to update estimates of desalination plants' discharge since the sharp increase in facilities over the past few decades and suggests there is an urgent need to find ways to deal with the huge amount of waste created at the plants, which remove salts from water in areas where freshwater is scarce. "Improved brine management strategies are required to limit the negative environmental impacts and reduce economic cost of disposal, thereby stimulating further developments in desalination facilities to safeguard water supplies," the authors wrote in the study, published today in *Science of the Total Environment*. The researchers found desalination plants are discharging more than 37 billion gallons of chemical-laden brine every day, which is a 50 percent increase over previous estimates. The authors note that amount is enough in a year to cover Florida under one foot of brine. Most desalination plants are in the Middle East and Africa and the paper found just four countries—Saudi Arabia, the UAE, Kuwait and Qatar—are responsible for about 55 percent of the world's total brine waste. Waste disposal largely depends on where a plant is located, however, most are near an ocean: almost 80 percent of global brine is produced within six miles of an ocean. "Brine underflows deplete dissolved oxygen in the receiving waters," lead author Edward Jones, a researcher at Wageningen University in the Netherlands, said in a statement. "High salinity and reduced dissolved oxygen levels can have profound impacts on benthic organisms, which can translate into ecological effects observable throughout the food chain." The study recognizes the important role desalination plays in getting people water. "Around 1.5 to 2 billion people currently live in areas of physical water scarcity, where water resources are insufficient to meet water demands, at least during part of the year. Around half a billion people experience water scarcity year-round," Vladimir Smakhtin, the assistant director of United Nations University's Institute for Water, Environment and Health, said in a statement. "There is an urgent need to make desalination technologies more affordable and extend them to low-income and lower-middle income countries." Brine waste does not have to be all bad news — Smakhtin and colleagues point to potential economic opportunities in "mining" it. With bolstered technology, metals and salts—such as sodium,

**Study finds desalination plants are discharging more than 37 billion gallons of chemical-laden brine every day.**

## Curiosities

### CHEMWATCH

magnesium, calcium, potassium, bromine, boron, strontium, lithium, rubidium and uranium—could be extracted from the brine and sold for industrial and agricultural uses. “There is a need to translate such research and convert an environmental problem into an economic opportunity,” co-author Manzoor Qadir, assistant director of United Nations University’s Institute for Water, Environment and Health, said in a statement. “This is particularly important in countries producing large volumes of brine with relatively low efficiencies, such as Saudi Arabia, UAE, Kuwait and Qatar.”

Environmental Health News, 15 January 2019

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

## Here’s The Simple Way to Lose Weight And Keep It Off, According to Science

2019-02-07

Losing weight is often at the forefront of many people’s minds at the start of the year. But if weight loss was your goal for 2019, chances are that by now, you’ve probably already experienced some challenges. That’s because sticking to a strict calorie-controlled diet is not an easy task in modern environments – where tasty and high energy foods are attractive and easily available. Dieting is also made particularly difficult by our body’s rapid response to decreases in food intake but opposing lack of response to overeating. This will be a familiar experience for many who have experienced almost immediate increases in hunger when dieting. Most people will also have experienced how easy it is to overeat during holiday periods or other occasions. A main course meal at a UK full service restaurant, for example, is likely to contain more than half of the calories required for an entire day.

### Overeating not detected

Our recent research has shown that overeating is poorly detected in humans, even when energy intake is increased to provide an excess of more than 1,000 calories per day. In this study, overeating with 150 percent of the required daily calories did not change the appetite of participants. We tested for this by looking at appetite ratings and levels of specific hormones known to regulate appetite, as well as checking the food intake of participants during the next day. Our findings showed how the body fails to adjust to account for these additional calories. This makes sense from an evolutionary perspective because in environments with limited access to food, overeating when food was available to our

**Losing weight is often at the forefront of many people’s minds at the start of the year.**

## Curiosities

### CHEMWATCH

ancestors would increase their chances of survival by keeping them fuelled until food was available again. This shows that being aware of calorie intakes is important because short periods of accidental overeating can be sufficient to cause weight gain or impair weight loss. Indeed, some evidence suggests that increases in body weight during the festive period are maintained throughout the rest of the year. And may also be responsible for incremental annual increases in body weight. Similarly, overeating on a weekend can easily cancel out a strict diet that is maintained on weekdays. But understanding how easy it is to overeat does not mean that weight loss can't be achieved. In fact, knowing this can help with weight loss – by being more aware of dietary choices.

#### Don't forget exercise

Despite our body's bias for weight gain, correct diet and lifestyle changes will produce and maintain weight loss if this is the desired aim. Exercise may often be overlooked as people seek "the best diet for weight loss". But getting active still remains important if you want to lose weight – and especially for maintaining weight loss over prolonged periods of time. Exercise can complement dietary changes and help to minimise the increases in hunger experienced from dieting alone. This is because exercise does not cause an increase in hunger to the same extent as dieting, despite also creating an energy deficit for weight loss. In fact, hunger is reduced when exercising intensely, which may help to stave off hunger pangs while increasing the energy deficit. The importance of exercise for maintaining weight loss was also recently highlighted with participants from the US televised weight loss competition, The Biggest Loser. The tracking of participants for six years after the show revealed that the people who maintained their weight loss had increased their physical activity by 160 percent. Whereas those who regained their lost weight had only increased physical activity by 34 percent.

#### Flexibility needed

Regardless of which dieting approach you choose, it is likely you will need a degree of flexibility – as most diets will require some compromise. Perhaps, for example, you are invited to attend a meal at a restaurant for a special occasion or there is a holiday celebration involving additional eating. Being aware that your body is not likely to respond to the increased calorie intake means that you can adjust your behaviour to avoid or compensate for any overeating, for example by being more mindful of food choices in the days before or after an occasion, or increasing your exercise levels to counter any excesses. What all this shows is that

## Curiosities

### CHEMWATCH

ultimately, we should not rely on feedback signals from our body to detect levels of calorie intakes. Instead, conscious monitoring of diet and lifestyle behaviours is more than sufficient to counter our body's natural bias for weight gain. And by appreciating this need for conscious monitoring, it may help you to achieve any desired weight loss goals over the year ahead.

Science Alert, 5 February 2019

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

### **Disturbing Video Footage Reveals How Tasers Can Actually Set a Person on Fire**

2019-02-07

Alarming video captured by a Twitter user in Philadelphia highlights a rare but little-known danger of electroshock Taser-style weapons. In the footage, posted recently, a man is seen struggling with security guards on the street, before being fired upon with a Taser-style device. Almost instantly, the man is a light, screaming in agony as his legs are engulfed in bright, burning flames. In seconds the incident is seemingly over, with the flames extinguished only moments later. The video – which had been viewed over 44,000 times at the point of writing this article – serves as a disturbing reminder of the dangerous and sometimes deadly consequences when electroshock weapons come into contact with flammable substances. It's not exactly clear what flammable materials contributed to the Philadelphia incident, but it's possible gasoline or oil on the street helped fuel the fire. In the earliest frames of the video, the man's legs are in contact with the street as the security guards try to hold him. However, while the man set alight certainly couldn't be called lucky, he may be fortunate the consequences of the blaze weren't even worse. According to Axon, the company that manufactures Tasers – the most prominent conducted electrical weapon (CEW) brand – at least 15 people have previously caught fire in what are known as Taser-initiated combustion incidents. Several of them died in these freak events, although media reports differ on the exact number of fatalities. What is certain is that it can and does happen. "We've seen it happen," company spokesperson Steve Tuttle told Associated Press in 2017. "It's happened about 15 times in 24 years ... out of about 3.5 million field uses. It's a known situation." According to Tuttle, Axon – formerly known as Taser International – has warned police and other Taser users of the dangers of using their stun guns around flammable substances since 1993, with a caution that "TASER devices can ignite explosive materials, liquids or

**Alarming video captured by a Twitter user in Philadelphia highlights a rare but little-known danger of electroshock Taser-style weapons.**

## Curiosities

### CHEMWATCH

vapours". As horrible as it sounds, the risks of being set on fire by a Taser or other stun gun device are incredibly low, especially in the context of other ways you could die after being tasered. A 2017 analysis by Reuters identified more than 1,000 incidents "in which someone died after being stunned with a Taser by police". Of course, it wasn't always the Taser that delivered the fatality in those events – it being just "one factor alleged in a broader array of force applied, such as punches, baton strikes and pepper spray". Grim statistics – which are all part of a much bigger problem.

Science Alert, 5 February 2019

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

### **A toxic-chemicals expert is sounding the alarm about 4 cancer-linked chemicals that could be making us sicker and fatter**

2019-02-07

Endocrine disruptors are chemicals that mess with the body's normal functioning. They can contribute to lowered IQs, raised infertility rates, obesity, and low birth weights, among other things. Leo Trasande, a paediatrician who studies the effects of these chemicals on people, warns of their effects in his new book, "Sicker, Fatter, Poorer." Trasande says that with a few simple hacks, we can make our lives a little safer by avoiding these chemicals when possible. The endocrine-disrupting chemicals he's most worried about are in our carpets, clothes, canned and packaged foods, cosmetics, and even receipts. Through the course of a single day, your hands, mouth, and body come in contact with countless pieces of paper, plastic, fabric, and furniture. You probably don't think about the chemicals these substances might harbour, or consider that they have a drug-like effect on health. But some do. They can make metabolisms slow down, subtly lower IQs, contribute to ADHD in children, and mess with sperm counts in men. They're called "endocrine disruptors," and they're around us all the time. The chemicals change how our bodies work by shifting the way hormones operate, according to Leo Trasande, a paediatrician and public-health researcher at NYU Langone Health. "Hormones are the basic signalling molecules in our body that take on so many actions for practically every organ system" Trasande told Business Insider. "And endocrine disruptors are synthetic chemicals that scramble those signals, contributing to disease and disability." In his new book, "Sicker, Fatter, Poorer: The Urgent Threat of Hormone-Disrupting Chemicals to Our Health and Future ... and What We Can Do About It,"

## Curiosities

### CHEMWATCH

Trasande lays out the four big categories of endocrine disruptors he's most concerned about, based on evidence from scientific studies and observations in his patients. They are:

- Bisphenols, like BPA, which are often found in the linings of aluminium-canned food and drinks and on cash-register receipts.
- Brominated flame retardants that are in some carpets, furniture, and clothing.
- Synthetic pesticides on food.
- "Plasticiser chemicals" called phthalates that show up in plastic food packaging, lotions, and cosmetics.

#### BPA makes fat cells bigger, contributing to obesity and lower sperm counts

The chemical BPA, and others like it, could make the body turn more calories into fat instead of muscle, predisposing people to obesity. In the lab, BPA acts like an obesogen. "It makes fat cells bigger," as Trasande writes. This is especially true if human embryos are exposed to the chemicals while still in a mother's womb. Trasande said the obesogen effects of BPA are fairly small compared to what diet and exercise can do for health, but they're real. "BPA exposure may explain nearly 2% of all obesity in 4-year-olds," Trasande says in his book. That stat is based on his analyses of data on childhood obesity and adult heart issues published in the journal *Health Affairs* in 2014. The chemical is also dangerous for babies and pregnant women; it can up the odds of a premature birth, and mess with placenta function. Bisphenols like BPA are chemicals that are used in manufacturing of both plastics and resins. We come into contact with them on thermal receipt paper, linings for canned food, some dental sealants, and plastic containers. Men are not immune to the effects of BPA, either. The chemical can mess with androgens (male sex hormones) like testosterone, contributing to lower sperm counts, and even testicular-cancer rates. The vast majority of us are exposed to the chemical. A 2013-14 CDC survey suggested 95% of US adults have detectable levels of BPA. Counter to the adage that "the dose makes the poison," with hormone-disrupting chemicals there are often nonlinear relationships between the amount of chemical exposure and risk as the body's enzymes duke it out and compete with the hormone disruptors. "The notion that everything needs to be linear – in a straight-line relationship – is really our own intellectual construct on a scientific reality that's much more complicated," Trasande says. Many manufacturers are switching to BPA-free products. But that doesn't always mean they're safer, Trasande says, because many of the so-called replacements are just BPA relatives and the chemicals have similar effects on our health. "To a large extent, when you don't know

## Curiosities

### CHEMWATCH

what's replacing [BPA], it's often BPS, BPF, BPP, BPZ – what I like to joke of as the artist formerly known as Prince," he said. Furniture foam often has firefighting chemicals in it. But they don't work very well, and they can change how our bodies process fat.

#### Brominated flame retardants found in most furniture we use

Brominated flame retardants – flame-stomping chemicals found in furniture, carpeting, clothing, and car-seat foam – can change the way the thyroid functions in a similar way to BPA, shifting how the body processes fats and carbohydrates. What's more, a 2012 Chicago Tribune investigation found that the firefighting chemicals, which are standard fare in foam cushions, don't work well to stop flames. One large study of the flame retardants in houses pinpointed a link between ADHD and exposure to the chemicals. More research is ongoing. Concentrations of the chemicals in human blood, sweat, and breast milk are much higher in the US than in parts of the world, such as Europe, where more brominated flame retardants are banned.

#### Chemicals we spray to kill bugs can mess with us too

Certain pesticides used on food are also a concern, including bug-killing chlorpyrifos pesticides. These have been shown to impede brain development, making changes to the way a woman's thyroid functions during pregnancy. In the 1970s and '80s, before the chemical was banned in homes, doctors started noticing an increase in tinier and shorter premature babies being born, even in homes with low levels of the chemicals. After the Environmental Protection Agency banned the use of chlorpyrifos in homes, in 2000, birth weights went back up. Exposure to chlorpyrifos can have lasting effects on child development. One 2015 study in kids between the ages of 11 and 14 found prenatal exposure to the chemical was linked to more arm tremors, which are also common in adults who've been exposed to lead. The chemicals are still used in agriculture.

#### Flexible plastics can also contribute to cancer

Finally, Trasande is concerned about phthalates, chemicals that help make plastics more flexible and durable. They appear in raincoats, flooring, hair spray, nail polish, plastic food packaging, and toys. According to the US government, "one phthalate, Di (2-ethylhexyl) phthalate (DEHP), is an endocrine disruptor and can cause cancer." Additionally, the government says some phthalates can mess with normal reproduction and child-development processes. In some studies, women tended to have more

## Curiosities

### CHEMWATCH

of the chemicals in their bodies than men because of beauty products they use. But anyone who eats packaged food or breathes in household dust probably has phthalates in their system. More research on what these chemicals are doing to us is needed, but we do already have some evidence that they're leading to premature births, which can set kids up for a whole host of health problems later in life, including vision and hearing issues, chronic diseases like diabetes, anxiety, depression, and learning disabilities. The plasticising chemicals may also be linked to decreases in male testosterone levels. Scientists need to know more about the plastics before they will say that conclusively, though. Recently, manufacturers, retailers, and state lawmakers have started to pay more serious attention to the dangers of hormone disruptors, and they're making some changes. Since 2013, California no longer requires furniture to contain flame retardants (a previous requirement for 38 years).

#### What you can do to reduce your exposure

Eat less canned food and more fresh produce. Trasande is a fan of organic farming because it generally excludes synthetic pesticides, but studies suggest that eating whatever fresh produce you can afford is the best strategy for your health. Say no to paper receipts. This can help receipt-handling cashiers, who often have elevated levels of BPA in their urine. Don't microwave plastic containers or put them in a dishwasher as the heat promotes chemical leaching. Throw kitchen plastics away when they become etched or scratched. Avoid the recycling Nos. 3, 6, and 7, which are common plastics found in shampoo bottles, Styrofoam trays for ground beef, and coffee-cup lids, among other things. Incorporate iodine-rich foods into your diet, including seafood, dairy, and cranberries. Iodine is a necessary ingredient for thyroid-hormone production, which helps bones and brains develop well. Look for cosmetics that are "phthalate-free" and made without parabens, triclosan, or benzophenones. Opt for naturally flame-resistant fibres, like wool, instead of chemically treated carpets, furniture, and clothes. Circulate fresh air through your home. Small steps like these can make a big difference. The European Union has banned 1,328 chemicals from cosmetic use, and under the new bans French scientists have noticed a decline in chemical concentrations in people's blood, urine, and hair. In the US, the FDA forbids just 11 chemicals, and concentrations of the toxic chemicals in American bodies are elevated when compared to Europeans. The US has taken steps to improve public health before. The phase-out of leaded gasoline and paint in the 1970s led to a measurable brainpower boost in kids: as blood lead levels dropped, IQs went up anywhere from 2.2 to 4.7%. The economic benefits of that ban

## Curiosities

### CHEMWATCH

tally up to \$US2.45 trillion every year, and Trasande compares the IQ hike's impact on productivity and the economy to a generous stimulus package: As Trasande writes, "Each of us 300 million Americans gets the equivalent of as much as a \$US1,000 tax refund each year because we did the right thing and got lead out of gasoline in the 1970s." Many of the chemicals on Trasande's danger list today stay in the body for hours or days, not months or years, which means it's never too late to reduce your exposure.

Business Insider, 3 February 2019

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

### Butter-Scented Chemical Linked to "Popcorn Lung" Discovered in Vape Juices

2019-02-07

In 2007, health officials in California revealed that numerous workers in local flavouring factories suffered from a rare, life-threatening lung condition called bronchiolitis obliterans, later nicknamed "popcorn lung." The illness, which scars the air sacs of the lungs and makes breathing difficult, stemmed from exposure to diacetyl, a yellow chemical used to give microwave popcorn its buttery flavour. Now, that chemical is at the centre of a new study revealing that it's harmful in vape liquids as well.

#### Why aren't e-cig users receiving the same warnings?

In the study, published in Scientific Reports, researchers from Harvard's T.H. Chan School of Public Health show that diacetyl, together with a similar chemical called 2,3-pentanedione, can impair the function of the lungs when it's inhaled. Flavouring chemicals are found in over 90 percent of commercially marketed flavoured e-cigarettes, and of those chemicals, diacetyl, is the most common, the authors report. 2,3-pentanedione is used as a substitute in e-liquids, they add, likely because diacetyl is associated with popcorn lung. The European Union banned diacetyl in vape liquids in 2016. Though these chemicals are considered safe ingredients to ingest in food, diacetyl's history strongly suggests that it's not safe to breathe in, especially not in vape form. Workers in flavouring factories now receive warnings about the dangers of inhaling flavouring chemicals, said co-senior author Joseph Allen, Ph.D., who asked: "Why aren't e-cig users receiving the same warnings?" Allen and another co-senior author, Quan Lu, Ph.D., led a team who investigated what these chemicals do to the human lung. Rather than experiment on actual humans, they used normal human bronchial epithelial cells — the ones

**Diacetyl, is at the centre of a new study revealing that it's harmful in vape liquids as well.**

## Curiosities

### CHEMWATCH

lining the lung — in a system closely mimicking a living human airway. They saw that exposing their artificial airway to the chemicals for 24 hours significantly decreased the lung's usual number of cilia, the finger-like protrusions that stick out from the surface of lung cells to sweep mucus and other dirt away from the lung and out through the mouth. Cilia, which can also be damaged by smoking, are often considered the lung's first line of defence against large irritating particles, which can be coughed out. Normally, 50 to 75 percent of cells lining the airway have cilia. Looking more closely at the genomes of these chemical-exposed cells, the team found that 163 genes were regulated differently after exposure to diacetyl; ditto for 568 genes after exposure to 2,3-pentanedione. Exposure to these chemicals via e-cigarettes for just 24 hours, the team concludes, changes the genes of cells in the airways, hampering their ability to sweep particles away. That can't be good, especially at the epidemic scale at which teens are using vapes. Originally marketed as a way to help people stop smoking — a claim that has some scientific support — vapes have been adopted as a new teen hobby. A lot of its immense popularity has been blamed on the fact that the e-liquids are so tasty and appealing to kids. Concerned San Francisco voters moved to ban flavoured vape products in June 2018 for this reason, though the continued rise in popularity shows that few other cities have followed suit. Other studies showing the cell-harming effects of other e-liquid chemicals imparting cinnamon and butter aromas exist, though the evidence hasn't been enough to stem vaping's tide. Complicating the research is the vaping industry itself, which has conducted its own studies on the usefulness of vape flavours for quitting smoking. The greatest concern about vaping's meteoric rise in popularity is that the science just can't keep up. Scientists need to conduct studies to find out whether vaping is addictive, is a "gateway drug," and has long-term effects, but between its introduction to society and its incredibly enthusiastic adoption, there hasn't been enough time to find out.

Inverse, 1 February 2019

<http://www.inverse.com>

### **Nanoparticles may promote cancer metastasis**

2019-02-07

Nanoparticles can be found in processed food (e.g. food additives), consumer products (e.g. sunscreen) and even in medicine. While these tiny particles could have large untapped potential and novel new applications, they may have unintended and harmful side effects, according to a recent

## Curiosities

### CHEMWATCH

study by researchers from the National University of Singapore (NUS). Specifically, NUS researchers found that cancer nanomedicine, which are designed to kill cancer cells, may accelerate metastasis. Using breast cancer as a model, they discovered that common nanoparticles made from gold, titanium dioxide, silver and silicon dioxide – and also used in nanomedicines – widen the gap between blood vessel cells, making it easier for other cells, such as cancer cells, to go in and out of “leaky” blood vessels. The phenomenon, named ‘nanomaterials induced endothelial leakiness’ (NanoEL) by the NUS team, accelerates the movement of cancer cells from the primary tumour and also causes circulating cancer cells to escape from blood circulation. This results in faster establishment of a bigger secondary tumour site and initiates new secondary sites previously not accessible to cancer cells. “For a cancer patient, the direct implication of our findings is that long term, pre-existing exposure to nanoparticles – for instance, through everyday products or environmental pollutants – may accelerate cancer progression, even when nanomedicine is not administered,” explained research co-leader Associate Professor David Leong from the Department of Chemical and Biomolecular Engineering at NUS Faculty of Engineering. He added, “The interactions between these tiny nanomaterials and the biological systems in the body need to be taken into consideration during the design and development of cancer nanomedicine. It is crucial to ensure that the nanomaterial delivering the anti-cancer drug does not also unintentionally accelerate tumour progression. As new breakthroughs in nanomedicine unfold, we need to concurrently understand what causes these nanomaterials to trigger unexpected outcomes.” The study, jointly led by Associate Professor Leong and Associate Professor Ho Han Kiat from the Department of Pharmacy at NUS Faculty of Science, was published in scientific journal Nature Nanotechnology on 28 January 2018. Fortunately, the situation is not doom and gloom. The NUS researchers are harnessing the NanoEL effect to design more effective therapies. For example, nanoparticles that induce NanoEL can potentially be used to increase blood vessel leakiness, and in turn promote the access of drugs or repairing stem cells to diseased tissues that may not be originally accessible to therapy. Associate Professor Leong said, “We are currently exploring the use of the NanoEL effect to destroy immature tumours when there are little or no leaky blood vessels to deliver cancer drugs to the tumours. We need to tread this fine line very carefully and optimise the duration at which the tumours are exposed to the nanoparticles. This could allow scientists to target the source of the disease, before the cancer cells spread and become a highly refractory problem.” Associate Professor Ho added, “Moving beyond cancer treatment, this phenomenon may also be exploited in

## Curiosities

### CHEMWATCH

other conditions where a failure of leakiness is a key feature. For instance, organ injuries such as liver fibrosis may cause excessive scarring, resulting in a loss in leakiness which reduces the entry of nutrient supplies via the blood vessels. Both our research groups are now looking into leveraging the NanoEL effect to restore the intended blood flow across the scarred tissues."

Phys.org, 1 February 2019

<http://phys.org>

### Female Brains Appear to Be More Youthful Than Male Ones, Study Suggests

2019-02-07

The jury is still out on whether cognitive differences between men and women are created by nature or nurture - or to what extent they even exist - but we do know that average structural differences between the sexes are a real thing. This latest research now indicates that female brains, on average, appear to be about three years more youthful than the brains of males of the same age when it comes to brain metabolism. This difference could be why women tend to stay mentally sharp for longer than men, the researchers said. "We're just starting to understand how various sex-related factors might affect the trajectory of brain ageing and how that might influence the vulnerability of the brain to neurodegenerative diseases," said neuroscientist Manu Goyal of the Mallinckrodt Institute of Radiology at Washington University School of Medicine in St. Louis. "Brain metabolism might help us understand some of the differences we see between men and women as they age." Scientists had already established that age-related grey matter volume decrease occurs more quickly in male brains than female brains. It's also been demonstrated that gene expression in the brain changes more rapidly in ageing men than women, resulting in a reduced ability to build and break down molecules in the male brain. These pieces of evidence are suggestive of a form of neoteny in the female brain, (assuming male brains as the baseline, which is something scientists do), but no one had looked at metabolism - how the brain runs on glucose - until now. As you age, the brain's use of glucose changes. In children, a metabolic process called aerobic glycolysis features heavily. It's associated with brain development, increasing in sync with synaptic formation and growth. This process slows down as we approach adulthood, and continues to slowly decline. The brain still uses sugar for cognitive function, but aerobic glycolysis plateaus at a low level usually by the time people are in their 60s. Obviously, the exact age can vary

**Scientists have just found a new distinction between the brains of the two sexes: age-related changes to the brain occur more slowly in women than in men.**

## Curiosities

### CHEMWATCH

from person to person, but to figure out if there are sex differences in that point, the research team conducted positron emission tomography (PET) scans on 205 people - 121 women and 84 men, from 20 to 82 years old. The researchers were looking at the flow of oxygen and glucose in their brains to determine the proportion of the glucose that was being allocated to aerobic glycolysis. They then fed a machine-learning algorithm the male sample data to establish a relationship between age and brain metabolism. Using this as a baseline, the researchers asked the algorithm to estimate the ages of the women based solely on their brain metabolism data. It calculated that the women were, on average, 3.8 years younger than they actually were. Then they did it in reverse. They used the women's data as a baseline, and estimated the men's ages based solely on their metabolism data. It calculated that the men were an average of 2.4 years older than their actual age. And, even more interestingly, this difference was observed even in people as young as their 20s. "It's not that men's brains age faster - they start adulthood about three years older than women, and that persists throughout life," Goyal said. "What we don't know is what it means. I think this could mean that the reason women don't experience as much cognitive decline in later years is because their brains are effectively younger, and we're currently working on a study to confirm that." In the next stage of their research, the team will be trying to determine if cognitive problems occur less frequently in people with brains that seem younger. The team's research has been published in the journal PNAS.

Science Alert, 5 February 2019

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

### **Marijuana smoking linked with higher sperm concentrations, study finds**

2019-02-07

Men who have smoked marijuana at some point in their life had significantly higher concentrations of sperm when compared with men who have never smoked marijuana, according to new research led by Harvard T.H. Chan School of Public Health. The study, conducted in the Fertility Clinic at Massachusetts General Hospital, also found that there was no significant difference in sperm concentrations between current and former marijuana smokers. "These unexpected findings highlight how little we know about the reproductive health effects of marijuana, and in fact of the health effects of marijuana in general," said Jorge Chavarro, associate professor of nutrition and epidemiology at Harvard

**Men who have smoked marijuana at some point in their life had significantly higher concentrations of sperm when compared with men who have never smoked marijuana, according to new research led by Harvard T.H.**

## Curiosities

### CHEMWATCH

Chan School. "Our results need to be interpreted with caution and they highlight the need to further study the health effects of marijuana use." The study will be published on February 5, 2019 in Human Reproduction. It is estimated that 16.5% of adults in the U.S. use marijuana, and support for legal recreational use of marijuana has increased dramatically in recent years. Understanding the health effects associated with marijuana use is important given the growing perception that it poses few health hazards. The researchers hypothesised that marijuana smoking would be associated with worse semen quality. Previous studies on marijuana have suggested that it is associated with negative effects on male reproductive health, but most of those studies had focused on animal models or on men with histories of drug abuse. For this study, researchers collected 1,143 semen samples from 662 men between 2000 and 2017. On average, the men were 36 years old, and most were white and college educated. Additionally, 317 of the participants provided blood samples that were analysed for reproductive hormones. To gather information on marijuana use among study participants, researchers used a self-reported questionnaire that asked the men a number of questions about their usage, including if they had ever smoked more than two joints or the equivalent amount of marijuana in their life and if they were current marijuana smokers. Among the participants, 365, or 55%, reported having smoked marijuana at some point. Of those, 44% said they were past marijuana smokers and 11% classified themselves as current smokers. Analysis of the semen samples showed that men who had smoked marijuana had average sperm concentrations of 62.7 million sperm per millilitre of ejaculate while men who had never smoked marijuana had average concentrations of 45.4 million sperm per millilitre of ejaculate. Only 5% of marijuana smokers had sperm concentrations below 15 million/mL (the World Health Organisation's threshold for "normal" levels) compared with 12% of men who had never smoked marijuana. The study also found that among marijuana smokers, greater use was associated with higher serum testosterone levels. The researchers cautioned that there are several potential limitations to the findings, including that participants may have underreported marijuana use given its status as an illegal drug for most of the study period. The researchers emphasised that they do not know to what extent these findings may apply to men in the general population as the study population consisted of subfertile men in couples seeking treatment at a fertility centre. Additionally, they noted that there are few similar studies to compare their results against. "Our findings were contrary to what we initially hypothesised. However, they are consistent with two different interpretations, the first being that low levels of marijuana use could benefit sperm production

## Curiosities

### CHEMWATCH

because of its effect on the endocannabinoid system, which is known to play a role in fertility, but those benefits are lost with higher levels of marijuana consumption," said Feiby Nassan, lead author of the study and a postdoctoral research fellow at Harvard Chan School. "An equally plausible interpretation is that our findings could reflect the fact that men with higher testosterone levels are more likely to engage in risk-seeking behaviours, including smoking marijuana.

Medical Xpress, 5 February 2019

<http://medicalxpress.com>

### Study reveals how immune cells target different tissues

2019-02-07

For the first time, researchers have revealed the different molecular identities of important immune cells, called T regulatory cells, using single cell genomics, in both mouse and human peripheral non-lymphoid tissues such as skin and colon. The researchers from the Wellcome Sanger Institute and their collaborators revealed that T regulatory cells have tissue-specific receptors and other adaptations, which allow them to move to and remain in the correct location in the body. In future, this could allow us to understand how to target therapeutic cells to specific places in the body, for targeted treatments of autoimmune diseases for example. Reported in *Immunity* (5th February), the study showed that mouse T regulatory cells had multiple intermediate cell states, within and between tissues. They also discovered similar patterns of gene activities in humans, revealing more detail than ever about how the immune system is regulated. T regulatory cells (Tregs) are a specialised type of immune cell that control the immune system. They dampen down the immune response to keep it in check and prevent the body attacking its own tissues. These cells are found in lymphoid tissue such as lymph nodes and spleen, and also in other non-lymphoid tissues in the body. While some differences are known about how T regulatory cells function in different tissues, understanding the "GPS system" that addresses cells to specific tissue in the body is limited. To create a detailed picture of T cells, the researchers studied 35,000 individual cells from healthy mouse lymph nodes, spleen, skin and colon, comparing cells across the different tissues. They used single-cell RNA sequencing to discover exactly which genes were switched on in each of the cells. The researchers discovered that different tissues had different populations of cells, and revealed the changes that T regulatory cells undergo when moving between tissues. Further analysis revealed that even within a single tissue, cells varied

**Researchers have revealed the different molecular identities of important immune cells, called T regulatory cells, using single cell genomics, in both mouse and human peripheral non-lymphoid tissues such as skin and colon.**

## Curiosities

### CHEMWATCH

greatly—with a continuum of cell states and regulatory activities. They also discovered that although the sequence of cell states is very similar when they migrate to different peripheral tissues such as skin and colon, cells express distinct chemokine ‘location’ receptors on their surface that act as a satnav to guide them to a specific- tissues. Tomas Gomes, joint first author from the Wellcome Sanger Institute, said: “This is the first time that anyone has described the huge varied spectrum of T regulatory cell populations in peripheral tissues. We can see that although these cells share the core identity of T regulatory cells, they are very different across different tissues, with different functions, and even express different receptors to guide them to a specific tissue. This is helping us understand the regulation of the immune system to keep it in a healthy balance.” The researchers analysed Tregs from mouse tumour and non-tumour cells in specific tissues and saw they had the same gene activities. Comparing the mouse data with Tregs from human skin, colon and blood tissues they discovered similar receptors and signalling molecules in humans. Prof Fiona Powrie, from the University of Oxford, said: “We now know that Tregs play unique roles in different tissues, some of which are distinct from their suppressive function. By revealing the common and distinct molecular signals that support different Treg populations, our study allows a better understanding of how Tregs interact with their environment to promote tissue health throughout the body.” Dr. Sarah Teichmann, corresponding author from the Wellcome Sanger Institute, said: “This is the most comprehensive study ever performed of single cell RNA sequencing of T regulatory cells across tissues. Not only does it help us understand the immune system within a tissue, it also reveals which regulators and receptors are expressed in each tissue. This could help researchers learn how to manipulate potential therapeutic T cells in the future, to design them for specific locations in the body and target exactly the right tissue needed.”

Medical Xpress, 5 February 2019

<http://medicalxpress.com>

### Teen e-cigarette use linked to eventual smoking

2019-02-07

Among teens, using e-cigarettes may raise the risk of progressing to cigarette smoking, a new U.S. study suggests. Overall, adolescents who used e-cigarettes before trying any other tobacco products were more than four times as likely to be smoking traditional cigarettes within a couple of years compared to those who had never tried any type of vaping

**Among teens, using e-cigarettes may raise the risk of progressing to cigarette smoking, a new U.S.**

## Curiosities

### CHEMWATCH

device or non-cigarette tobacco products, the study team reports in JAMA Network Open. "E-cigarettes may be a pathway to cigarette smoking, and a sizeable one," said senior study author Andrew Stokes of the Boston University School of Public Health. Overall, smoking rates have dropped significantly, Stokes said. "That's been a real success story for public health and in that context, it's pretty alarming that a new product has come on the market potentially drawing a whole generation into using tobacco," he added. Stokes and his colleagues explored the influence of e-cigarettes through the Population Assessment of Tobacco and Health Study (PATH), a nationally-representative sample of kids aged 12 to 15 who completed annual questionnaires between 2013 and 2016. Along with questions about vaping and smoking, the surveys asked about kids' socioeconomic backgrounds and their attitudes about smoking. They were also asked questions designed to illuminate how prone they were toward risky behaviours and sensation-seeking. Those who reported using a tobacco product in the three years of surveys were asked which of 12 products they had "tried first," including traditional cigarettes, cigars, pipes, hookahs, chewing tobacco, snus and e-cigarettes. Stokes and his colleagues focused on the 6,123 kids who said in the first-wave survey that they had never used any tobacco product. By the third survey, 6.1 percent of these kids reported smoking or having tried traditional cigarettes. Among kids who had first tried e-cigarettes, just over 20 percent had tried or were regularly smoking cigarettes by wave three, and among kids who first tried other non-cigarette tobacco products, more than 21 percent had tried or were smoking cigarettes. That compares with just 4 percent of kids who had not used any type of non-cigarette tobacco products. Researchers calculated that the odds of trying traditional cigarettes or becoming regular smokers were 4.09 times higher for those who tried e-cigarettes first, and 3.84 times higher after trying other non-cigarette tobacco products first. But for those kids considered to be at low risk for taking up smoking – who had initially said they had no interest in smoking, were risk averse and less likely to seek out new experiences – first using e-cigarettes raised the risk of eventual smoking by 8.57 times. This added risk wasn't seen among first users of other non-cigarette products. Stokes suspects that there are several reasons why kids who don't see themselves ever smoking cigarettes might be open to vaping. First, he said, many don't realise that nicotine is a highly addictive substance. "And there is also the 'cool factor,'" he said. "The flavours are very appealing and we know that they are disproportionately appealing to youth, who are exposed to a lot of marketing targeted to them on social media." The new findings are "pretty consistent with what we've seen before in this area in terms of demonstrating that people who experiment with electronic cigarettes,

## Curiosities

### CHEMWATCH

even if they swear at baseline that they would never smoke regular cigarettes, are at much more risk of transitioning to regular cigarettes," said Dr. Brian Primack, director of the Centre for Research on Media, Technology and Health at the University of Pittsburgh in Pennsylvania. The new study "strengthens earlier findings in a couple of ways," Primack said. "First, this is a very large and prestigious database and that is important with an area as controversial as this. You want to make sure your evidence is as strong as possible. The other thing it does is show that the magnitude of risk is even higher for those at low risk for using cigarettes. We've been seeing hints of this all along. And this is particularly problematic for people who probably would never have touched a cigarette to begin with."

Reuters Health, 1 February 2019

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

## Vitamin or Mineral Supplements Don't Prevent Dementia

2019-02-07

A large review of studies has found no solid evidence that vitamin and mineral supplements have any effect in preventing cognitive decline or dementia. The meta-analysis, published in the Cochrane Database of Systematic Reviews, included 28 trials with more than 83,000 cognitively healthy people 40 and older. The reports covered a wide range of vitamins and minerals, alone and in combination, in various dosages, with follow-ups as long as 18 years. Eight studies looked at the antioxidants beta carotene, vitamin C and vitamin E. One compared vitamin D and calcium to placebos. A trial of zinc and copper supplementation included more than a thousand participants, and one on selenium had more than 3,700. There were 17 trials of B vitamins or combinations of them with antioxidants and minerals. The scientists were unable to find any good evidence that vitamin or mineral supplementation had a meaningful effect. There was some suggestion of a benefit in long-term supplementation with antioxidants, but even there the evidence was weak. "We're a little disappointed," said Dr. Naji Tabet, a researcher in psychiatry at Brighton and Sussex Medical School in England and one of the study's authors. "We expected to find some evidence of a noticeable impact. But based on this study — the largest of its kind, I believe — there

**B vitamins; beta carotene; vitamins C, D or E; zinc, copper or selenium — none proved effective in preventing cognitive decline.**

## Curiosities

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is no effective vitamin or mineral supplement that a clinician can feel comfortable in recommending to prevent cognitive decline.”

New York Times, 4 February 2019

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

### Scientists identify reversible molecular defect underlying rheumatoid arthritis

2019-02-07

Stanford University School of Medicine investigators succeeded in countering inflammation and tissue damage caused by rheumatoid arthritis in mice engrafted with human joint-lining tissue and a human immune system. The researchers accomplished this by shutting down a faulty molecular mechanism that they identified in humans with the disease. In addition, they found that a novel drug, which is not yet commercially available, helped protect both human cells in a dish and the humanized mice from rheumatoid arthritis. Clinical trials of the drug or a closely related compound could begin in the near future. The findings were published online Feb. 4 in *Nature Immunology*. Cornelia Weyand, MD, Ph.D., professor and chief of immunology and rheumatology, is the senior author. The lead author is postdoctoral scholar Zhenke Wen, MD, Ph.D. Rheumatoid arthritis is one of the most common autoimmune diseases, affecting about 1 percent of the population. It involves destruction of synovia, soft tissue that lubricates joints to prevent bones from scraping together. Whereas osteoarthritis is attributable to age-related wear and tear, rheumatoid arthritis results from a chronic attack on the synovia by cells of the body's immune system. The inflammatory character of rheumatoid arthritis also causes systemic problems. For example, it doubles the risk of heart disease. Existing rheumatoid-arthritis medications relieve symptoms but don't actually eradicate the disease by rectifying the behaviour of the immune cells causing it, Weyand said. Why those cells go on the attack to begin with has been mysterious. But Weyand's team has clues. "We've learned that rheumatoid arthritis is, at root, a problem of faulty cell metabolism and, in particular, of one type of immune cell's inappropriate diversion of resources from generating energy to the production of an army of inflammatory offspring," she said. This cellular army exits the lymph nodes, makes its way to synovial tissues, takes up residence there and instigates the inflammatory damage that's the hallmark of rheumatoid arthritis. "We know how these immune cells fuel their bad behaviour," Weyand said. "And now we've shown we can reverse this behaviour and make these cells behave as they should."

**In rheumatoid arthritis, immune cells called helper T cells behave differently from their counterparts in healthy cells and in other autoimmune diseases. Stanford scientists have learned why.**

## Curiosities

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#### Errant helper T cells

The errant cells are helper T cells. After infiltrating synovial tissue, they send out signals that call in other super-aggressive immune cells and cause ordinary synovial cells to become inflamed and destructive. In prior work, Weyand's group noticed telling differences between the helper T cells of patients with rheumatoid arthritis and those of healthy people. The former, for instance, have low reserves of a molecule called ATP, which serves as cell's internal energy currency, accepted by all of a cell's myriad metabolic enterprises. Yet instead of directing their primary energy source, glucose, toward ATP production, these cells divert their glucose supplies toward fashioning various materials—proteins, nucleic acids, membranes and the like—used to build new T cells that will contribute to further damage. That shouldn't happen. Like all cells, T cells contain AMPK, a regulatory molecule that senses ratios of ATP and its two main breakdown products. If it finds ATP too outnumbered by these breakdown products, AMPK clamps down on the T cell's cell-building program and, instead, sends glucose off to the cell's ATP-generating apparatus. "When your house is cold, you need to throw your logs into your fireplace, not use them to build a new house in your backyard," Weyand said. The new study provides an answer to the question of why AMPK fails to perform its energy-monitoring function in the faulty helper T cells of patients with rheumatoid arthritis. To redirect glucose traffic from biosynthesis to internal energy production, AMPK must first be activated. This happens when a small chemical group gets tacked onto AMPK, starting it up like the ignition of a car. That, in turn, can occur only on the outer surface of vesicles called lysosomes. Lysosomes have a reputation as cells' garbage disposals because they're full of cellular debris in the act of being recycled. But they're more than that. Their membrane surfaces are dotted with all manner of receptors, channels, enzymes and other proteins. Only when AMPK perches on the lysosomal surface and seats itself in a large protein supercomplex there does it get activated and poised to shut down an ATP-deficient helper T cell's biosynthetic materials-building apparatus and redirect glucose back to ATP production. Weyand's team obtained blood samples from 155 rheumatoid arthritis patients, an equivalent number of healthy subjects and a smaller number of patients with other autoimmune disorders. They extracted helper T cells from these samples and, analysing them, found several striking differences. Rheumatoid arthritis patients' T cells had just as much AMPK as cells from healthy subjects or patients with other autoimmune diseases did. But their AMPK molecules weren't getting activated. Nor were they as likely to turn up on lysosomal surfaces. AMPK molecules in these cells were also much less likely to feature molecules of

## Curiosities

### CHEMWATCH

a substance called myristic acid affixed to their back ends. Rheumatoid-arthritis helper T cells also had much-reduced levels of the enzyme NMT1, whose job is to staple myristic acid “tails” to proteins’ back ends. These tails, Weyand and her colleagues found, act as anchors pinning AMPK to the lysosomal surface. Laboratory techniques that increased NMT1 levels in rheumatoid-arthritis helper T cells caused the cells’ secretions of inflammatory chemicals to drop. When injected into mice with human synovial tissue, unmodified helper T cells from rheumatoid arthritis patients caused severe damage to the human synovial tissue. But those with lab-enhanced levels of NMT1 produced far less inflammation or tissue damage. An exploratory compound, A769662, that causes AMPK to become activated even when it’s just floating around in a cell’s cytoplasm rather than anchored to a lysosome reversed rheumatoid-arthritis helper T cells’ inflammatory output and their propensity to infiltrate and damage human synovial tissue in the mice, the study found. Weyand said she expects to test the efficacy of the compound, or a derivative, among rheumatoid arthritis patients in a clinical trial, hopefully in the near future.

Medical Xpress, 5 February 2019

<http://medicalxpress.com>

## Technical Notes

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