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

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### ASIA PACIFIC

#### Workplace Exposure Standards—consultation update

2019-01-22

SafeWork Australia has thanked everyone who participated in the public consultation process for the Workplace Exposure Standards, which is now closed. 31 submissions were received from WHS regulators, government, industry and industry groups, unions, professionals and other interested or affected people. A consultation summary and the submissions received are now available to read on Safe Work Australia's consultation platform, [Engage](#). The feedback received will be used to inform the decision regulation impact statement to be released in early 2019. The *Consultation regulation impact statement: Workplace exposure standards framework under the model Work Health and Safety (WHS) laws* was prepared to assist WHS ministers to determine the impact of, and best way to implement, an update to the workplace exposure standards. It also explores if the workplace exposure standards should remain mandatory under the model WHS laws or if advisory status is more appropriate. [Subscribe](#) to the 'chemical exposure standards' mailing list to receive alerts and updates about workplace exposure standards.

Safe Work Australia, 13 December 2018

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

#### Droplet size classification

2019-01-22

Following the October 2018 suspension of 2,4-D labels and release of new label instructions under PER87174, there has been some misunderstanding regarding the instructions around the droplet size classification required under the permit. Under the 2,4-D permit PER87174, there is an instruction to apply this herbicide with a nozzle that produces at least VERY COARSE spray droplets to minimise the impact of spray drift with this herbicide. This nozzle classification is according to the ASAE S572.1 definition. The Australian Pesticides and Veterinary Medicine Authority (APVMA) recognises five different standards for droplet size classification (three versions of ASAE, BCPC and ISO), however ASAE S572.1 version is quoted in the permit since it is the most widely accepted standard used by industry. It is important to note that all five nozzle classification standards are compliant with the new 2,4-D instructions. Following the release of the 2,4-D permit, there has been some criticism

**SafeWork Australia has thanked everyone who participated in the public consultation process for the Workplace Exposure Standards, which is now closed.**

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associated with using the ASAE S572.1 standard for a number of reasons, including incorrectly perceived changes in testing protocols between standards leading to changes in spray quality. All five standards are based on spraying water only. Further explanation of the different standards for droplet size classification can be found in the [technical note on standards for the classification of nozzles in Australia](#). Overall, the implementation of new instructions for 2,4-D has been largely embraced by industry, who have recognised and accepted the importance of correct nozzle selection to minimise spray drift of 2,4-D. Whilst S572.1 should be followed in accordance with the new 2,4-D instructions, all ASAE, BCPC and ISO standards comply with the updated label instructions.

APVMA, 11 December 2018

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

### Cancellation of Product Registration and Label Approval at the Request of the Holder

2019-01-22

At the request of the holder, the Australian Pesticides and Veterinary Medicine Authority (APVMA) has cancelled the product registration and the label approval of the following product:

Product no	Product name	Label approvals	Registrant	Date of effect
83490	Boviseal Intramammary Suspension for Cattle	108453	Bimeda (Australia) Pty Limited	20 December 2018

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

**SUPPLY:** A person may supply or cause to be supplied the cancelled product manufactured prior to 20 December 2018 at wholesale and retail level, until the 20 December 2019. After 20 December 2019 it will be an offence against the Agvet Codes to have possession or custody of the cancelled product with the intention to supply, or to supply the product.

**USE:** A person may continue to use the cancelled product according to its label instructions until 20 December 2019. Any person who possesses, has custody of, uses, or otherwise deals with the cancelled product in accordance with the above instructions is taken to have been issued with

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a permit under the Agvet Codes to so possess, have custody of, use or otherwise deal with the cancelled product after the registration has been cancelled until 20 December 2019. The supply and use of the cancelled product must be in accordance with the conditions of registration or approval, including any conditions relating to the shelf life or expiry date. It is an offence to possess, have custody of, use, or deal with the cancelled product listed in the table in a manner that contravenes the above instructions.

APVMA Gazette, 15 January 2019

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

### 28 Substances Added to China's Existing Chemical Inventory

2019-01-22

On 14 January 2019, 28 new chemical substances were added to China's Inventory of Existing Chemical Substances (IECSC). They were previously notified under China's new chemical notification system and five years have passed since they were first manufactured or imported. There is no tonnage limit after they are listed in the IECSC. The IECSC serves as the basis to judge whether a substance is identified as new chemical subject to notification. It will be dynamically updated since more and more notified new substances will be qualified for listing into the inventory. Therefore, confirmation of whether the substance in your product falls under IECSC is essential before your entering the Chinese market. The last update to the IECSC was made in Nov 2018, adding 45 substances. Further information is available at: [MEE Announcement No. 1 of 2019](#)

Chemlinked, 17 January 2019

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

### China to Issue the ODS Quota for Manufacture/Use/Import

2019-01-22

On 3 January 2019, China's Ministry of Ecology and Environment (MEE) published a notice on [2019 quota allocation for ODS \(Ozone Depleting Substances\) manufacture, use and import](#), involving 6 HCFCs and carbon tetra chloride. According to the consensus made in Montreal Protocol, China will incrementally decrease the HCFC consumption and production, culminating in comprehensive HCFC phase-out by 2030. The

**On 14 January 2019, 28 new chemical substances were added to China's Inventory of Existing Chemical Substances (IECSC).**

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manufacture, use and import of ODSs shall be approved and overseen by the government. Compared with the quota allocation in 2018, the 2019 manufacture quota is reduced by 5%, from 368,675 tons to 350,008 tons of HCFC in total, and the usage quota is reduced from 63,882 tons to 63,049 tons. What's notable in 2019 ODS quotas is that import allocation is firstly mentioned in the notice since China signed the Montreal Protocol. 2 companies are permitted to import HCFC at a gross of 113.088 tons, which are:

Company Name	HCFC Type	Import Quota (ton)
<u>Chemours (Shanghai)</u>	HCFC-123	74
<u>AGC Chemicals Trading (Shanghai) Co.,Ltd</u>	HCFC-225	39.088

Other quotas allocation is available in MEE website, click [here](#) for the details. Further information is available at: [MEE NEWS](#)

Chemlinked, 14 January 2019

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

### US backs industry concern over South Korea's OSHA changes

2019-01-22

The United States has backed its industry's concerns over major changes to South Korea's Occupational Safety and Health Act (OSHA). In a 21 December communication to the WTO, the US called on South Korea's environment and employment and labour ministries (MOE and MoEL) to fully consider concerns raised by industry in letters sent last in March. In one of those letters, obtained by Chemical Watch, the American Chemistry Council (ACC) argued that proposed changes to South Korea's Occupational Safety and Health Act (OSHA)– also known as the Industrial Safety and Health Act – will “breach” international norms on confidential business information (CBI) and introduce unnecessary duplicate registration under K-REACH. The revisions to OSHA are currently approaching the country's legislature. Although not confidential, the letter dated 19 March has not previously been made public. Among the ACC's concerns, are:

- the broad requirements for disclosure information on chemical components to the MoEL and in safety data sheets (SDS), which it says will undermine CBI and create onerous administrative burdens; and

**Disclosure requirements said to 'breach' GHS standards**

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- the unnecessary duplication of new substance registrations in K-REACH and Osha that it says will create substantial extra work.

The letter argued that the amount of information required by the amendments undermines CBI protection and is in breach of the internationally established UN Globally Harmonised System (GHS) of classification. In particular, the ACC's letter took issue with the OSHA amendment's requirement for the disclosure of information on chemical components of mixtures. It said this goes against established standards under GHS, which maintain a focus on hazards. As end users do not extract components, the components themselves are not generally relevant to health and safety, it said. The US statement to the WTO repeated many issues from a statement it made in June on how South Korea's revised K-REACH is being implemented.

Chemical Watch, 10 January 2019

<http://chemicalwatch.com>

### Taiwan's parliament passes major toxic chemical act revamp

2019-01-22

Taiwan's parliament has enacted sweeping changes to the country's toxic chemical law, the Toxic Chemicals and Concerned Substances Control Act (TCCSCA). Previously known as the Toxic Chemical Substance Control Act the latest move comes after all four major legislative parties signed off on an agreed version in consultations earlier this month. The revisions were approved by the legislature more than a year after the Executive Yuan, Taiwan's Cabinet, submitted the changes to it in November 2017. A statement issued by the EPA's Toxic and Chemical Substance Bureau said the revisions will usher in a "new era of toxic chemical substance regulation" in Taiwan and highlighted the following seven key aspects to the revamped framework:

- increasing the scope of regulation to "substances of concern" that may not be directly toxic, but nonetheless carry health and safety risks;
- a new chapter on accident prevention and emergency response;
- forming a national chemical management board convened by the premier to bolster horizontal coordination among ministries involved in chemical regulation;
- establishing a toxic and chemical substance fund with registration fees and fines collected by the EPA from chemical users to finance

**Revisions approved  
a year after Cabinet  
submitted changes**

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programs that bolster point-of-origin regulation and help companies lower disaster response costs;

- measures to help reduce incident reporting times from one hour to 30 minutes and have better reporting of storage and use of dangerous chemicals to fire departments and other local authorities;
- prohibitions on purchasing without clear identification, for example through online sales, of toxic and chemical substances; and
- increased provisions to protect and reward whistle-blowers together with stiffer measures to confiscate profits from illegal activities.

After the completion of the third reading, Democratic Progressive Party (DPP) legislator Ms Wu Yu-chin said the revised law will “strengthen the government’s capability to carry out point of origin regulation and expedite better cooperation between the central and local governments in ensuring food safety”. Ms Wu added she had called on the government to introduce a new chapter of the law devoted to bolstering toxic chemical disaster prevention and response to improve coordination between government and users and measures to improve disaster prevention and response training and capabilities in chemical producers and users. Further information is available at: News release (in Chinese)

Chemical Watch, 21 December 2018

<http://chemicalwatch.com>

## AMERICA

### Notice of Extension of the Public Comment Period for the Notice of Intent to List: *p*-Chloro- $\alpha,\alpha,\alpha$ -trifluorotoluene (Para-Chlorobenzotrifluoride, PCBTF)

2019-01-22

On 23 November 2018, the California Environmental Protection Agency’s (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) published in the *California Regulatory Notice Register* (Register 2018, No. 47-Z) a Notice of Intent to List *p*-chloro- $\alpha,\alpha,\alpha$ -trifluorotoluene (also known as *para*-chlorobenzotrifluoride, or PCBTF) as known to the state to cause cancer under the Safe Drinking Water and Toxic Enforcement Act of 1986. The 23 November 2018 notice initiated a 30day public comment period that was scheduled to close on 24 December 2018. OEHHA has received a request from the American Coatings Association seeking an extension of the comment period. OEHHA hereby extends the public comment

**OEHHA has extended the public comment period for the Notice of Intent to List: *p*-Chloro- $\alpha,\alpha,\alpha$ -trifluorotoluene (Para-Chlorobenzotrifluoride, PCBTF) until 23 January 2019.**

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period until Wednesday 23 January 2019. Comments may be submitted electronically (preferred) through our website at <https://oehha.ca.gov/comments>. Comments received during the public comment period will be posted on the OEHHA website after the close of the comment period. By sending us your comments you are waiving any right to privacy you may have in the information you provide. Individual commenters should advise OEHHA when submitting documents to request redaction of home address or personal telephone numbers. Electronic files submitted should not have any form of encryption. Further information is available at: [Notice of Extension of the Public Comment Period for the Notice of Intent to List: p-Chloro-a,a,a-trifluorotoluene](#)

OEHHA, 14 December 2018

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

### US lawmakers' bill would trigger clean-up of PFAS

2019-01-22

A new United States congressional bill that would deem all per- and polyfluoroalkyl substances (PFAS) as hazardous substances will pave the way for federal clean-up of PFAS-polluted sites, proponents say. But makers and formulators of these chemicals say lumping them together for regulation isn't scientifically valid. "Our bipartisan legislation will list all PFAS as the hazardous chemicals we know they are and give the [Environmental Protection Agency] the tools it needs to clean up contaminated sites," says Rep. Debbie Dingell (D-Mich.), who introduced the bill 14 January with fellow Michigan lawmakers Reps. Dan Kildee (D) and Fred Upton (R). The districts they represent, as well as others in the state, are contending with contamination of drinking water with PFAS leaching from industrial landfills or washed into groundwater from the use of fire-fighting foams that contain the chemicals. The bill, which has not yet been assigned a number, would require the EPA to designate all PFAS as hazardous substances under the US federal Superfund law, which addresses clean-up of toxic waste sites. This designation, in turn, would require companies or others to report releases of PFAS into the environment and make them liable for clean-up. In addition, it would allow the federal government to clean up PFAS-polluted sites and recoup the costs from polluters. Deeming PFAS as hazardous substances "would help potentially hundreds of communities impacted by PFAS contamination to hold polluters accountable and get resources to finally begin the desperately needed clean-up process," says Scott Faber, a senior vice president of the advocacy group Environmental Working Group

**A new United States congressional bill that would deem all per- and polyfluoroalkyl substances (PFAS) as hazardous substances will pave the way for federal clean-up of PFAS-polluted sites, proponents say.**

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(EWG). The organisation and researchers from Northeastern University are tracking known PFAS contamination sites in the US, listing 172 locations in 40 states as of July 2018. EWG estimates that water supplies for as many as 110 million US residents may be tainted with PFAS. Exposure to some PFAS chemicals is linked to adverse effects in the liver, kidney, blood, and immune system and in foetuses, according to the EPA. But little, if any, toxicity data exist for thousands more of these substances in commerce. Some PFAS are polymers, which are likely to pose little risk for health effects. Because of the diversity of these chemicals, manufacturers are raising concerns about the legislation that would treat them all the same. "It is scientifically unsound to consider regulations or policies that address PFAS chemistry as a uniform class. PFAS are a broad and diverse class ... including many different substances that vary significantly in their structures, properties, uses, and hazard profiles," the FluoroCouncil, an industry group of companies that make, process, or formulate PFAS products, says in a statement. Any regulation of these substances, the council adds, "should be informed by a full understanding of the risks and benefits of different PFAS." In September, Democrats in the Senate urged the EPA to regulate PFAS in drinking water as a class rather than to control each chemical individually. The agency pledged to issue a national plan by the end of 2018 for managing PFAS contamination. That action is in limbo as the federal government shutdown continues.

Chemical & Engineering News, 15 January 2019

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

### Canada consults on informed substitution study

2019-01-22

The Canadian government is seeking input on informed substitution within its chemicals program, as part of its ongoing effort to determine the future of chemicals management in the country. Informed substitution – or "the considered transition from a chemical of concern to safer chemicals or non-chemical alternatives" – is among the policy options Canada is considering incorporating in its next phase of chemicals management, once work planned under the Chemicals Management Plan (CMP) ends in March 2021. The government commissioned the US-based Lowell Centre for Sustainable Production to examine how Canada can advance alternatives assessments in its future approaches. And it has now opened a consultation to solicit feedback on the proposed activities outlined in the resulting study, released last year. Among the recommendations made in the Lowell study is "establishing a solutions-oriented, interdepartmental

**Feedback sought to inform post-2020 chemicals management approaches**

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umbrella policy/program that links traditional regulatory approaches with non-regulatory incentives and supportive actions that drive innovation in, and adoption of, safer chemistry". A post-2020 plan would not just seek to address 'bad actors', but would also encourage the "development, adoption, and use of chemicals and chemical products that are safer and more sustainable, promoting the goals of green chemistry," it adds.

As part of the consultation, the government has posed several questions it is seeking to be addressed. These are:

- who should be involved in informed substitution considerations, and what role does each play?;
- are there elements missing from the study?; and
- what are the potential costs, benefits and impacts of informed substitution?.

Comments will be accepted through 18 March. A consultation on defining vulnerable populations is ongoing. Comments are due by 21 January. Further information is available at:

- Informed substitution
- Lowell study
- Post-2020 consultations

Chemical Watch, 17 January 2019

<http://chemicalwatch.com>

## EUROPE

### EU proposes to restrict some siloxanes, formaldehyde, and microplastics

2019-01-22

On 11 January, the European Chemicals Agency (ECHA) announced that it intends to prohibit the sale in the EU of products containing octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5), and dodecamethylcyclohexasiloxane (D6), all of which are or have been used in cosmetics and cleaning products. The restriction would be for concentrations greater than 0.1%, although the proposal does not specify whether this is by weight or by volume. In addition, the proposal would restrict the use of formaldehyde and of formaldehyde releasers, which are used as an antimicrobial preservative in consumer products. Plus, ECHA plans to halt the intentional addition of microplastics to any

**The European Union is proposing to tighten regulation of three cyclic methylsiloxanes, formaldehyde and chemicals that release formaldehyde, and microplastics.**

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consumer or professional product. In a related action, Germany is seeking ECHA restrictions on the manufacture and sale of perfluorohexanoic acid, its salts, and related substances. These chemicals are found in some consumer products and are ubiquitous and persistent in the environment, Germany says.

Chemical & Engineering News, 19 January 2019

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

### **EU Biocides Regulation 528/2012 (EU BPR) – ECHA’s open invitation following withdrawal of support for (ethylenedioxy)dimethanol PT2 from the biocides active substance review program**

2019-01-22

The European Chemicals Agency (ECHA) has published an open invitation, which allows interested companies to take over the role of participant for the above active substance/product type combination. Interested companies should complete the notification procedure in Article 17 of the Review Regulation by the 01 October 2019. Notifications should be submitted to the European Chemicals Agency (ECHA), via R4BP3. If no-one takes over the role of participant, the active substance/product type combination will be subject to a non-approval decision and products containing it for the affected product type will have to be removed from the market.

HSE, 15 January 2019

<http://www.hse.gov.uk/>

### **Lack of EU regulatory coherence ‘impacting’ mobile phone and textiles sectors**

2019-01-22

The absence of coherent regulation in the EU means that potentially hazardous chemicals are “continuously” being used in all stages of the production process in the textiles industry, a Norwegian study has said. And current EU policies for this sector and for mobile phones “often let member states shape the laws and their implementation themselves”, the European Sustainable Market Actors for Responsible Trade (Smart) project said in a release. This leads to “more use of chemicals and less sustainable waste management”. Smart, funded by EU research and

**(Ethylenedioxy) dimethanol (reaction products of ethylene glycol with paraformaldehyde (EGForm)) (CAS No. 3586-55-8) for product type 2 is no longer considered to be supported in the biocides active substance review program,**

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innovation programme Horizon 2020, focuses on the environmental and social footprint of global supply chains for clothes and mobile phones. It comprises researchers from 25 institutions from around the world. It started in March 2016 and will run until February 2020. The EU today has “a wide range of sustainability-oriented policies and regulations, but there is a lack of coherence and sufficiently stringent and enforceable regulation,” Smart project leader Beate Sjøfjell said. “Reforms adopted by the EU to promote sustainability often give a broad scope to the member states on how to implement these. Unfortunately, member states tend to aim for minimum implementation, out of fears of jeopardising their own competitive position or that of their businesses,” she added. Commenting on the study, Mauro Scalia from textiles and apparel industry association Euratex said: “Coherent regulation is already in place, yet the enforcement is a competence of the member states and it significantly varies, both on domestic production and especially on imported goods.” He added that “different and difficult” enforcement and non-application of REACH outside the EU can lead to chemicals being used in “very different ways” in textile manufacturing globally. That, however, does not mean a “responsible business would use more chemicals within the current EU regulatory framework”, he said. On the contrary, Mr Scalia added, an “ample set” of high-level industry standards have “for decades” ensured strict levels of protection. Considering the mobile phone sector, the Smart project said lack of consistency means hazardous materials end up being spread across the world, often in low-income countries where waste management is lacking. In Ghana, for example, phones are used and repaired until “only a few parts” are “collected for recycling abroad, and most just gets thrown away”, Smart’s Maja Van der Velden said.

“The lack of sustainable recycling practices leads to the pollution of land, water and air,” she added.

#### Missing information

It is not easy for consumers to consider sustainability when making their purchasing decisions because “there is a lack of public information from the companies regarding their business operations and their various impacts,” Smart’s María Jesús Muñoz Torres said. Smart’s Tineke Lambooy added that the EU should “introduce new regulation that mandates companies to disclose reliable and comparable information, and operate in a more sustainable way”. Businesses, she went on, “cannot do this alone because there has to be a level playing field. So, it is up to the regulators to introduce this, at least that is what many companies and/or their representatives express.” The Smart project results will be presented on 24

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January at the European Commission Department for Justice (DG Just) in Brussels. DG Just is responsible for the Commission's policies on justice, consumer rights and gender equality. Further information is available at: [Press release](#)

Chemical Watch, 9 January 2019

<http://chemicalwatch.com>

## REACH Update

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### ECHA reorganises to help take on new tasks and face future challenges

2019-01-23

Together with the revision of the European Chemicals Agency's (ECHA) strategy, the Agency has re-aligned its organisation to help it meet future challenges. The new organisational structure entered into force on 1 January 2019, after the adoption of the strategy by the Management Board in December 2018. The new structure reflects ECHA's broad capacity to implement chemicals legislation, including information submission; dissemination, data mining, grouping and prioritising chemicals; assessing chemical hazards and exposure; risk management and socio-economic analysis. "Our vision is to be the centre of knowledge on the sustainable management of chemicals, serving a wide range of EU policies and global initiatives, for the benefit of citizens and the environment. Together with our partners we will continue to work effectively for the safe use of chemicals", says ECHA's Executive Director Bjorn Hansen. While aiming to ensure continuity of operations, re-organising ECHA allows the Agency to focus on its strategic priorities, work more efficiently and flexibly, and make the best use of staff competences to take on new tasks. One new director and a number of new heads of unit will be appointed in the new organisation. The recruitment process is currently ongoing. Further information is available at:

- [ECHA's new organisation](#)
- [Descriptions of directorates and units](#)
- [ECHA Strategic Plan 2019-2023](#)

ECHA, 10 January 2019

<http://echa.europa.eu>

### Six new substances added to the Candidate List

2019-01-23

The European Chemicals Agency (ECHA) has added five new substances to the Candidate List due to the carcinogenic, toxic to reproduction, persistent, bioaccumulative and toxic (PBT) and very persistent and very bioaccumulative (vPvB) properties of the substances. The decision to include the four polycyclic aromatic hydrocarbons (PAHs) was taken with the involvement of the Member State Committee (MSC). The four PAH cases were referred to the MSC in order to address new hazard information submitted during the public consultation. One further substance has also

**The reorganisation aims to support the implementation of ECHA's new strategy, step up work in key areas, allow efficient and flexible ways of working, and enable ECHA to take on more responsibilities.**

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been added to the list having been identified as an SVHC by the European Commission due to its endocrine-disrupting properties. The Commission's decision follows the referral of the MSC opinion on this SVHC proposal in 2016. Substances included in the Candidate List for authorisation on 15 January 2019 and their SVHC properties:

#	Substance name	EC number	CAS number	Reason for inclusion	Examples of use(s)
1	2,2-bis(4'-hydroxyphenyl)-4-methylpentane	401-720-1	6807-17-6	Toxic for reproduction (Article 57c)	No active registrations under REACH.
2	Benzo[k]fluoranthene	205-916-6	207-08-9	Carcinogenic (Article 57a) PBT (Article 57d) vPvB (Article 57e)	Not yet registered under REACH.
3	Fluoranthene	205-912-4	206-44-0	PBT (Article 57d) vPvB (Article 57e)	Not yet registered under REACH.
4	Phenanthrene	201-581-5	85-01-8	vPvB (Article 57e)	Not yet registered under REACH.
5	Pyrene	204-927-3	129-00-0	PBT (Article 57d) vPvB (Article 57e)	Used as a transported intermediate for the manufacture of fine chemicals.
6	1,7,7-trimethyl-3-(phenylmethylene)bicyclo[2.2.1]heptan-2-one	239-139-9	15087-24-8	Endocrine disrupting properties (Article 57(f) - environment)	Not yet registered under REACH.

Furthermore, one dossier submitter (the German competent authority) decided to withdraw its proposal to identify undecafluorohexanoic acid and its ammonium salt (PFHxA) as an SVHC during the MSC agreement-seeking process.

### Background

The Candidate List is a list of substances that may have serious effects on human health or the environment. Substances on the Candidate List

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are also known as substances of very high concern and are candidates for eventual inclusion in the Authorisation List. Once they are on the Authorisation List, industry will need to apply for permission to continue using the substance after the sunset date. Companies may have legal obligations resulting from the inclusion of the substance in the Candidate List. These obligations may apply to the listed substance on its own, in mixtures or in articles. In particular, any supplier of articles containing a Candidate List substance above a concentration of 0.1 % (weight by weight) has communication obligations towards customers down the supply chain and consumers. In addition, importers and producers of articles containing the substance have six months from the date of its inclusion in the Candidate List (15 January 2019) to notify ECHA. Information on these obligations and related tools are available on ECHA's website. Further information is available at:

- [The Candidate List for authorisation](#)
- [Summary of obligations resulting from inclusion in the Candidate List](#)
- [Agreements of MSC on SVHC identification proposals](#)
- [How to submit substances in articles notifications](#)
- [Integrated Regulatory Strategy](#)

ECHA, 15 January 2019

<http://echa.europa.eu>

### ECHA to provide recommendations for occupational exposure limits

2019-01-23

The European Commission and the European Chemicals Agency (ECHA) have signed an agreement for the Agency to provide recommendations on a regular basis for occupational exposure limits (OELs) that protect workers exposed to hazardous chemicals. The agreement requires ECHA to assess four to five OELs per year from 2020 onwards. *"The preparation of scientific dossiers proposing occupational exposure limit values for chemicals under the Carcinogens and Mutagens Directive and the Chemical Agents Directive is a significant new activity for ECHA. It is part of ECHA's strategy to provide integrated proposals to the Commission on how to regulate risks posed by chemicals to European citizens, workers and the environment,"* states ECHA's Executive Director Bjorn Hansen. *"I am very pleased that we now can rely on ECHA. Having one common source for scientific advice under REACH and the health and safety at work directives will ensure coherence and further transparency,"* confirms Joost Korte, Commission Director-General

**The European Commission and the European Chemicals Agency (ECHA) have signed an agreement for the Agency to provide recommendations on a regular basis for occupational exposure limits (OELs) that protect workers exposed to hazardous chemicals.**

## REACH Update

### CHEMWATCH

for Employment, Social Affairs and Inclusion. This new program of OEL development will start right away, most likely with lead as the first priority at the request of the Commission's DG Employment. ECHA's Secretariat will make proposals for ECHA's Committee for Risk Assessment (RAC) to review and adopt scientific opinions on. The opinions will be forwarded to the Commission for decision making. There is also the potential for ECHA to further support the Commission by assessing the socio-economic impacts in parallel to developing the OELs. ECHA ran a pilot project between 2017 and 2018 which delivered five OEL recommendations within one year. These are currently passing through the decision-making process of the Commission. Based on the experience from the pilot, ECHA will ensure an open and transparent process through public consultations. The work on OELs will bring employers and trade unions even closer to ECHA's operations. ECHA already has substantial expertise in-house and in the field of occupational safety and health (OSH), and has recently strengthened RAC's expertise with newly co-opted members as well as through the regular membership. The agreement with the Commission follows the second REACH Review, in which one of the proposed action points was to improve the interface between REACH and OSH legislation. OELs are at the core of ensuring the protection of workers exposed to hazardous chemicals in the workplace. Further information is available at:

- [Committee for Risk Assessment \(RAC\)](#)
- [DG Employment](#)
- [European Agency for Safety and Health at Work \(EU-OSHA\)](#)
- [Directive on carcinogens or mutagens at work \(2004/37/EC\)](#)
- [Directive on risks related to chemical agents at work \(98/24/EC\)](#)

ECHA, 21 January 2019

<http://echa.europa.eu>

### New restriction intention submitted

2019-01-23

Germany has submitted a restriction intention on the manufacture and placing on the market of undecafluorohexanoic acid (PFHxA), its salts and related substances (EC -). The expected submission date for the dossier is 27 September 2019.

ECHA News, 16 January 2019

<http://echa.europa.eu>

**Germany has submitted a restriction intention on the manufacture and placing on the market of undecafluorohexanoic acid (PFHxA), its salts and related substances (EC -).**

## REACH Update

CHEMWATCH

### Registry of restriction intentions

2019-01-23

On 11 January 2019, ECHA submitted proposals to restrict:

- microplastics (EC -) - [details](#);
- formaldehyde and formaldehyde releasers (EC/CAS -) - [details](#); and
- octamethylcyclotetrasiloxane (D4) (EC 208-764-9), decamethylcyclopentasiloxane (D5) (EC 209-136-7) and dodecamethylcyclohexasiloxane (D6) (EC 208-762-8) - [details](#).

ECHA's committees are currently performing conformity checks on the dossiers. The dossiers will be published on ECHA's website on 30 January, to ensure transparency and that stakeholders have enough time to prepare for the six-month public consultations. The public consultations will start in April 2019 if the dossiers pass conformity. Further information is available at : [Registry of restriction intentions](#)

ECHA News, 16 January 2019

<http://echa.europa.eu>

## Janet's Corner

**CHEMWATCH**

**Chemist Dog**

2018-12-20

What kind of dog does  
a Chemist have?



**A Lab!**

## Hazard Alert

### CHEMWATCH

#### Carbaryl

2018-12-10

Carbaryl is the common name for a chemical known as 1-naphthyl methylcarbamate. Its chemical formula is  $C_{12}H_{11}NO_2$ , and molecular weight is 201.2 g/mol. Carbaryl is a white crystalline solid that is slightly soluble in water. It is essentially odourless and its odour threshold has not been established. Carbaryl was first registered in the United States in 1959. Currently, over 300 products containing carbaryl are actively registered with the United States Environmental Protection Agency. Carbaryl belongs to a family of chemicals that kill or control insects known as carbamates. [1,2]

#### USES [3]

Carbaryl is commonly sold under the trade name Sevin, and goes by trade names such as Adios, Carbamec, Denapon, Hexavin, and Panam. Its primary use is as an insecticide on various commercial crops, including but not limited to corn, soybean, cotton, citruses, pears, and nuts. In addition to also being effective as a molluscicide and acaricide, carbaryl can also be used to treat pest infestations, such as that due to species of lice, on livestock, poultry, pets, and in the case of head lice, on people.

#### IN THE ENVIRONMENT [1]

- Soil: Depending upon conditions, carbaryl has a half-life ranging from 4 to 72 days in soil. Carbaryl breaks down faster in sandy, flooded, or well-aerated soils.
- Plants: Carbaryl has an average half-life of 3.2 days on plant leaves.
- Water: Carbaryl does not dissolve well in water and sticks to soil. However, carbaryl is widely used and can last a long time under the right conditions. Carbaryl is commonly found in groundwater.
- Air: Carbaryl has low potential to evaporate from water, soil, and other treated surfaces.
- Carbaryl is practically non-toxic to birds such as ducks, quail, geese, and pheasants.
- It ranges from slightly to highly toxic to several species of fish.
- Carbaryl ranges from moderately to very highly toxic to marine invertebrates, such as shrimp and oysters.

**Carbaryl is the common name for a chemical known as 1-naphthyl methylcarbamate.**

## Hazard Alert

### CHEMWATCH

- Carbaryl is very highly toxic to aquatic invertebrates such as shrimp and stoneflies. It can also damage frog tadpoles during their development.
- Carbaryl is very high in toxicity to honey bees and can harm beneficial insects.

### SOURCES & ROUTES OF EXPOSURE

#### Sources of Exposure [2]

- Individuals are most likely to be exposed to carbaryl dermally or by inhalation during the manufacture, formulation, and application of this pesticide.
- The general public may be exposed to carbaryl from spray drift in regions surrounding agricultural areas.
- Carbaryl has been detected at low levels in surface water and in food.

#### Routes of Exposure [4]

The main exposure routes for carbaryl are:

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

### HEALTH EFFECTS [2]

#### Acute Effects

- Acute occupational exposure of humans to carbaryl has been observed to cause cholinesterase inhibition (which impairs central nervous system (CNS) function), resulting in nausea, vomiting, bronchoconstriction, blurred vision, convulsions, coma, and respiratory failure.
- Acute carbaryl exposure in humans may also cause eye and skin irritation.
- Tests involving acute exposure of rats, mice, rabbits, and guinea pigs have demonstrated carbaryl to have moderate to high acute toxicity from ingestion and moderate acute toxicity from dermal exposure.

## Hazard Alert

CHEMWATCH

### Chronic Effects

- Chronic exposure to carbaryl results in cholinesterase inhibition, which is reversible upon discontinuation of exposure. Headaches, memory loss, muscle weakness and cramps, and anorexia are caused by prolonged low-level exposure of humans to carbaryl resulting from cholinesterase inhibition.
- Kidney and liver effects have been observed in rats chronically exposed to carbaryl by ingestion.
- EPA has not established a Reference Concentration (RfC) for carbaryl.
- The Reference Dose (RfD) for carbaryl is 0.1 milligrams per kilogram body weight per day (mg/kg/d) based on kidney and liver toxicity in rats.

### Reproductive/Developmental Effects

- No information is available on the reproductive or developmental effects of carbaryl in humans.
- Two studies produced teratogenic effects in dogs fed carbaryl, but dogs were judged inappropriate for human health risk assessment because of differences in metabolism. Other studies demonstrating teratogenic effects also caused maternal toxicity.
- Reduced fertility and litter size and increased mortality in offspring have been observed in rats exposed to carbaryl in their diet over three generations.

### Cancer Risk

- No information is available on the carcinogenic effects of carbaryl in humans.
- No significant increase in tumour incidence was found among exposed animals in several studies.
- EPA has not classified carbaryl for carcinogenicity.

### **SAFETY [5]**

#### First Aid Measures

- Swallowed: If poisoning occurs, contact a doctor or Poisons Information Centre (ph: 13 11 26).
- Eye: Immediately irrigate with copious quantities of water for at least 15 minutes. Seek medical assistance.

## Hazard Alert

### CHEMWATCH

- Skin: If material is splashed onto the skin, remove any contaminated clothing and wash skin thoroughly with water and soap if available and give one atropine tablet every 5 minutes until dryness of the mouth occurs. Urgently transport to hospital or doctor.
- Inhaled: Remove victim to fresh air. Apply resuscitation if victim is not breathing - **DO NOT** use direct mouth-to-mouth method if victim ingested or inhaled substance; use alternative respiratory method or proper respiratory device - Administer oxygen if breathing is difficult.
- Give on atropine tablet every 5 minutes until dryness of the mouth occurs. Seek immediate medical assistance.

#### First Aid Facilities:

- Eye wash fountain;
- Safety shower and normal wash room facilities.

#### Exposure Controls & Personal Protection

##### Engineering Controls

- Carbaryl is a toxic material and a single significant exposure may cause death.
- Maintain adequate ventilation at all times.
- Prevent accumulation of gas(es) in hollows or sumps.
- Eliminate any sources of ignition.
- DO NOT enter room unless monitored by another person (ie buddy-buddy system).
- Sampling of the atmosphere if possible should be conducted automatically instead of human operator and any leaks discovered should then be directed digitally to a command centre where the event can be acted upon, with all appropriate procedures being implemented and including any protective equipment as outlined in this MSDS.

##### Personal Protective Equipment

The following personal protective equipment is recommended when handling carbaryl:

- CLOTHING: PVC, Nitrile, Neoprene, Natural rubber or any other type of apron or splash suit as recommended by the manufacturer.
- GLOVES: PVC, Nitrile, Neoprene, Natural rubber or any other type of glove as recommended by the manufacturer.
- EYES: Chemical goggles or face shield to protect eyes.

## Hazard Alert

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- **RESPIRATORY PROTECTION:** Avoid breathing of gases. Select and use respirators in accordance with AS/NZS 1715/1716. When gases exceed the exposure standards then the use of an atmosphere-supplied, positive pressure demand self-contained or airline breathing apparatus supplied air respirator complying with the requirements of AS/NZS 1715 is recommended. Filter capacity and respirator type depends on exposure levels.
- If entering spaces where the airborne concentration of a contaminant is unknown then the use of a self-contained breathing apparatus (SCBA) with positive pressure air supply complying with AS/NZS 1715 / 1716, or any other acceptable International Standard is recommended.

### REGULATION

#### United States [4,6]

NIOSH: The National Institute of Occupational Safety & Health has set a Relative Exposure Limit (REL) for carbaryl of TWA 5 mg/m<sup>3</sup>.

OSHA: The Occupational Safety & Health Administration has set a Permissible Exposure Limit (PEL) for carbaryl of TWA 5 mg/m<sup>3</sup>.

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

#### Australia [7]

Safe Work Australia: Safe Work Australia has set a Time Weighted Average (TWA) concentration for an 8-hour workday of 5 mg/m<sup>3</sup> for carbaryl.

### REFERENCES

1. <http://npic.orst.edu/factsheets/carbgen.pdf>
2. <http://www.epa.gov/ttn/atw/hlthef/carbaryl.html>
3. <http://www.toxipedia.org/display/toxipedia/Carbaryl>
4. <http://www.cdc.gov/niosh/npg/npgd0100.html>
5. <http://www.kendon.com.au/Catalogue/MSDS/horticultural/CarbarylLiquidInsecticide.htm>
6. <http://www.cdc.gov/niosh/idlh/63252.HTML>
7. <http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/772/Workplace-exposure-standards-airborne-contaminants.pdf>

## Gossip

### CHEMWATCH

#### Fluoride-ion battery runs at room temperature

2018-12-17

Batteries that outperform today's lithium-ion variety, in terms of how much energy they can cram into a small lightweight package, could push electric vehicle usage into high gear. A new study detailing an electrochemistry advance may nudge one such high-energy-density type, the fluoride-ion battery (FIB), from the drawing board toward application. Rechargeable FIBs, which in theory can hold about eight times as much energy per volume as current lithium ion batteries can, aren't new, but they are uncommon. That's because these devices generate electricity by shuttling fluoride ions from one electrode to the other through a fluoride-ion-conducting electrolyte. The electrolytes are solids, and to coax them to conduct substantial ion currents, they need to be heated above 150 °C, which severely limits applications. Now, a large team of researchers, including Simon C. Jones of California Institute of Technology and Christopher J. Brooks of the Honda Research Institute, have come up with a liquid electrolyte that shuttles fluoride ions to and fro and demonstrated its use in a room-temperature, rechargeable FIB (Science 2018, DOI: 10.1126/science.aat7070). To make the electrolyte solution, the scientists searched for a combination of a fluoride salt and solvent that provided ample solubility, high ionic conductivity, and electrochemical stability. The search led to a neopentyl alkylammonium fluoride and bis(2,2,2-trifluoroethyl)ether, or BTFE. Then the researchers devised a novel cathode consisting of a copper core and a lanthanum trifluoride shell. The shell prevents copper dissolution and BTFE decomposition while allowing facile diffusion of fluoride ions between the liquid electrolyte and the copper core. The diffusion enabled reversible conversion of copper to copper fluoride during charging cycles. In a proof-of-concept demonstration, the team made test cells with those components and operated them at room temperature for seven charging cycles. "These results open up new opportunities for the scientific community" in high-energy-density batteries, says Jun Liu, a specialist in energy storage materials at Pacific Northwest National Laboratory. The study demonstrates good progress, Liu notes, but it also underscores the need for "much more research in this area" to develop a long-lasting, viable fluoride-ion battery that can exceed the performance of Li-ion batteries in terms of charge capacity.

Chemical & Engineering News, 10 December 2018

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

**New liquid electrolyte nudges high-energy-density device toward application**

## Gossip

### CHEMWATCH

#### Newcomers head for zero-calorie sweetener market

2018-12-17

Amyris will launch a new zero-calorie sweetener for foods, beverages, and tabletop packets. Companies based on fermentation technology are pushing into the business of making rebaudioside M, a zero-calorie sweetener now extracted from the stevia plant. The Bay-area biotech firm Amyris says it will launch a Reb M-based sweetener in 2019 for use in foods, beverages, and tabletop packets. It will produce the molecule from sugarcane syrup via fermentation with modified microbes. Amyris intends to produce Reb M on a large scale and at purity levels above 95%. The firm points out that plant-based stevia sweeteners can contain bitter-tasting molecules. Reb M is considered the sweetest of stevia glycosides, but it exists in only tiny quantities in the stevia plant. Amyris has linked up with ASR Group, the cane sugar refiner that owns the Domino Sugar and C&H Sugar brands. ASR has agreed to buy 80% of Amyris's sweetener output for three years. Another partner, Camil Alimentos, will market the sweetener to retail customers in Brazil. Also, in Brazil, Amyris has inked a manufacturing partnership with cane sugar producer Raizen. And shoppers in the South American country will be the first to try a tabletop sweetener version of Reb M, made with help from the Swiss flavour firm Givaudan. Amyris is not the only firm pursuing fermentation-derived steviol glycosides. Last month, agribusiness giant Cargill and specialty chemical firm DSM linked up to produce rebaudioside M and D. They are forming a new company, Avansya, that will make the sweeteners at a Cargill facility now under construction in Blair, Neb. Smaller firms including the start-up Manus Bio and the natural ingredients supplier Blue California also have the capability to make the glycosides via fermentation. Yet plant-derived stevia sweeteners have a decades-long head start over the new competition. At PureCircle, a pure-play stevia supplier to the food industry, CEO Maga Malsagov disputes the idea that plant-based sweeteners are low-purity. "Our products are 95-98% pure," he tells C&EN. Malsagov says brands use stevia sweeteners because ingredients made directly from plants is what their customers want. And he says scale and cost aren't limiting use of stevia sweeteners. "The cost of the products we supply today is cheaper than sugar or high-fructose corn syrup. As we achieve economies of scale, that will come down even more." The new sweeteners have an opportunity to horn in on the market for artificial sweeteners, suggests Kantha Shelke, principal at food science and research firm Corvus Blue. "They would appear to have an edge over synthetic sweeteners, especially in today's 'clean label' climate," she says. For Amyris and Avansya, taste will be more important than cost in appealing to food and beverage

**Amyris and partners are latest to launch a fermentation-derived stevia**

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formulators, Shelke adds. "People are really tired of bad-tasting sugar alternatives. The concept of pure molecules tasting better than the plant-derived counterparts has to be proven in the marketplace."

Chemical & Engineering News, 6 December 2018

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

### **Yin and yang: Opposites in nature, fluoride and lithium, compete for higher energy batteries**

2018-12-17

The chemical element that makes up most of today's batteries, lithium, may soon be challenged by its polar opposite on the Periodic Table: fluoride. Yes, the same stuff in toothpaste. The two elements would be in competition for helping electronics last longer on a charge, such as electric cars that need to travel more miles than is possible with lithium-ion batteries on the market. Researchers are one step closer to equipping fluoride-based batteries for battle with improvements that allow the technology to operate at room temperature. Up until this point, fluoride had been limited to building high-temperature batteries that are impractical for our electronic devices. A team of researchers at the Jet Propulsion Laboratory, the California Institute of Technology (Caltech), the Honda Research Institute, Inc. and Lawrence Berkeley National Laboratory - including a Caltech postdoctoral researcher who is now an assistant professor at Purdue University - has secured two U.S. patents for the improvements and published findings in the Dec. 6 issue of the journal *Science*. Fluoride has long been in the running to trump lithium because of its potential for better energy storage in electrodes, which ions move between to charge a battery. "Fluoride-based battery electrodes can store more ions per site than typical lithium-ion electrodes, which means that this technology has the capability to be much more energy dense," said Brett Savoie, a Purdue assistant professor of chemical engineering. Lithium and fluoride share a yin-and-yang relationship: lithium is the most electropositive element on the Periodic Table, meaning that it likes to lose electrons, while fluoride is the most electronegative element, only wanting to acquire electrons. Giving lithium electrons it doesn't want stores energy, while taking electrons away from fluoride also stores energy. To build a battery, the ions of elements like fluorine and lithium must dissolve into the battery's electrolyte, a solution that helps them to travel between electrodes. The problem is that fluoride ions have only been able to dissolve well into solid electrolytes, limiting their use to high-temperature batteries. For fluoride-based batteries to operate at room

**The chemical element that makes up most of today's batteries, lithium, may soon be challenged by its polar opposite on the Periodic Table: fluoride.**

## Gossip

## CHEMWATCH

temperature, fluoride ions would need to dissolve better into a liquid electrolyte, like lithium ions do. The technology could then move towards unseating lithium, a cation-based battery, as the first high-performing, anion-based rechargeable battery. Researchers at the Jet Propulsion Laboratory discovered a liquid electrolyte, a synthesised molecule called BTFE, which allows fluoride to dissolve at room temperature. Savoie helped to make this discovery by simulating how BTFE and other related solvents successfully dissolve fluoride. BTFE is made up of several chemical groups that are arranged to give the molecule two positively charged regions that strongly interact with fluoride, since opposites attract. Simulations showed how these charged regions lead BTFE molecules to surround fluoride and dissolve it at room temperature. Savoie's simulations also provided a mechanism for testing other solvents on fluoride, such as "glyme" molecules that expand the voltage and stability window of BTFE. This means that the battery would be less likely to fail at higher voltages. The next step in beefing up fluoride-based batteries is extending the lifetimes of the positive and negative electrodes, called the cathode and anode. The team has already made some headway with this by stabilising the copper cathode so that it doesn't dissolve into the electrolyte. Battery testing is underway. The work was supported by the Resnick Sustainability Institute and the Molecular Materials Research Centre, both at Caltech, the National Science Foundation, the Department of Energy Office of Science and the Honda Research Institute. This research also aligns with Purdue's Giant Leaps celebration, acknowledging the university's global advancements made toward a sustainable economy and planet as part of Purdue's 150th anniversary. This is one of the four themes of the yearlong celebration's Ideas Festival, designed to showcase Purdue as an intellectual centre solving real-world issues.

EurekAlert, 6 December 2018

<http://www.eurekalert.org>

## Jellyfish offer a sticky solution to the problem of plastic pollution

2018-12-17

Our hunt has got off to a slow start. When the sea is choppy, spotting our quarry is hard. But as the sun rises higher, our efforts are finally rewarded. Shielding her eyes against the light bouncing off the water, Tjaša Kogovšek points to a faint dark blob. Our boat moves closer, and she plunges her net in to scoop the creature into a white bucket. We have bagged our first trophy of the day. I am in the Gulf of Trieste off the coast of Slovenia

**Our oceans are full of microplastics and unnatural swarms of jellyfish. Could these beautiful animals possess a secret weapon to help clean up the environment?**

## Gossip

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catching jellyfish with researchers from the country's National Institute of Biology. Knowing their catch will ultimately die, Kogovšek has mixed feelings about the hunt. "At the beginning it was very difficult," she says, "because their destiny is not nice after they are in my hands." But she is also well aware that an explosion in jellyfish numbers in recent years is a serious problem, both for us and for the marine environment. And the international project Kogovšek is part of, called GoJelly, sees that as an opportunity. It believes it can tap these ethereal creatures to tackle another environmental scourge of our time: microplastic pollution. If successful, it will be a win-win.

#### A blooming problem

Jellyfish are among a select group of organisms that seem to thrive as humans trash Earth. Exactly why isn't known, but one factor could be fewer competitors due to overfishing. Others may be the spread of jellyfish in ships' ballast tanks, and the fact that jellies can live in oxygen-depleted, polluted waters. Whatever the causes, larger, more frequent jellyfish blooms – dense swarms of the creatures – are occurring in many parts of the world. That is bad news for tourism when they force beaches to shut. The blooms can play havoc with vital services, too, from power stations to water treatment plants, if they are sucked into water intakes. And they are also a problem for other marine life, and for fisheries, because jellyfish feed on fish larvae, so a rising population upsets the balance of already fragile ecosystems. Extreme measures are being explored to reduce their numbers, such as acoustic shocks, electrocution and robot shredders. GoJelly's approach seems tame in comparison. What truly sets it apart, however, is its aim to put excess jellyfish to good use. One of the creature's key means of defence is the mucus it secretes. The dream is that this sticky substance can be used to filter microplastics out of water. It may sound fanciful, but GoJelly is in earnest. The project has been given €6 million by the European Union, and consists of 15 research teams in eight nations. This reflects the urgent need to reduce the increasing amount of tiny, non-biodegradable bits of plastic in the environment, in wildlife and even in the food we eat. The day's hunt over, back at the lab Kogovšek and her colleague Katja Klun measure each animal in the haul. There are dozens of native fried egg jellyfish (*Cotylorhiza tuberculata*), all around 30 centimetres in diameter, and some much smaller invaders from western Atlantic coastal waters called warty comb jellyfish (*Mnemiopsis leidyi*). Their ultimate destiny is to be chopped up and frozen, but first they are lightly stressed – prodded in their large white buckets – so that they secrete mucus. Then Klun extracts the transparent goo with a syringe,

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separating it from the seawater. It is an unusual job for a chemist. "I wasn't used to working with slimy creatures," she says. Nevertheless, her expertise is invaluable. She is analysing the chemical and physical properties of mucus from the jellyfish caught off Slovenia, and by GoJelly teams from Israel to Norway.

The roots of this surprising endeavour lie in the work of French scientists. In 2015, a team led by Philippe Barthelemy at the University of Bordeaux revealed that jellyfish mucus can filter gold nanoparticles from water. Like microplastics, they are tiny and do not react readily with other chemicals. The group found that the gloop from some jellyfish species made a better filter than that of others. For now, Klun's focus is on the stability of the gloop. It is rich in protein, glycoprotein, sugars and other substances, making it an ideal home for bacteria, which start to break down its constituent chemicals within hours, turning it from a viscous slime to a more watery substance. So Klun compares mucus from different species and individuals, and is experimenting with ways to keep the gelatinous structure intact. There is a way to go to show that this gloop can be used to filter microplastics – GoJelly only began in January 2018 – but Klun is optimistic. She holds up a test tube and swirls the contents. "You can already see just using your eyes that it is trapping plastics," she says. "GoJelly is even exploring the possibility of using jellyfish collagen in cosmetics". The next big challenge is to create a mucus-based filter that can be fitted to the outlets of commercial wastewater treatment plants. That task falls to Dror Angel at the University of Haifa, Israel, and his colleagues. "At the moment, we have no idea what this filter will look like," he says. "We're probably talking about something that has a large surface area, so that it has maximum contact with the particles in the water that it is treating." It also needs to be inexpensive, and easily inserted into existing treatment facilities. Cracking the mucus instability problem will be key for Angel's team. "One of the things that we have found is that it isn't that easy to work with," he says. "So, will it have the same properties over a period of time? Or do we need to freeze it? Refrigerate it? There's a whole big question of how to process the mucus initially to be able to use it." It is early days, but his team hopes to have a prototype filter ready for testing at a local wastewater treatment plant sometime in 2019. GoJelly's ambitions don't end there. The project is also exploring ways to make use of the leftover creatures. An Italian team wants to turn them into food, and is consulting partners in China where jellyfish have been a part of the diet for centuries. In Portugal, Norway and Germany, teams aim to turn them into feed for fish farms and fertilisers. GoJelly is even exploring the possibility of using jellyfish collagen in cosmetics. All this makes Kogovšek

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### CHEMWATCH

feel better about the hunt. "I hope we can benefit from the jellyfish bloom and not just see them as pests," she says. "They are very beautiful animals."

New Scientist, 12 December 2018

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

### The electric cars of the future could be recharged in 15 minutes

2018-12-17

The next generation of electric cars could charge their batteries in the time it takes to fill up at a gas station. A group of companies including Germany's BMW (BMWYY), Porsche and Siemens (SIEGY) say they have developed technology that could help make super-fast charging a reality. They unveiled a 450 kW charging station that needs only three minutes to provide enough juice for a 100-kilometre (62 miles) drive. A full charge takes 15 minutes. Ian Ellerington, head of technology transfer at the Faraday Institution, said the technology is significantly better than what's currently available, even if there are major issues to resolve before it's put into widespread use. "450kW is substantially quicker than the Tesla superchargers (120kW), and would in principle be 10 times quicker than the rapid chargers that are currently widely available," he said.

#### The slow charging problem

Long charging times are a major drawback of electric cars currently on the market. They slow down road trips, and they're a major inconvenience for owners who can't charge their cars at home. Ellerington said the next generation of chargers could help solve the problem. "At 350-450kW, electric charging will take a time comparable to refuelling with gasoline, which will make long journeys in [electric vehicles] as practical as in cars using liquid fuels," he said.

#### Power trouble

More development work is needed to make 450 kW chargers a practical option, however. According to Ellerington, one major piece of the puzzle is building cars that can handle the increased power. "I believe that there are no vehicles currently on the market that could accept this amount of power, and it will need the next generation of batteries to take advantage of the full capability," he said. For the 450 kW charging project, BMW and Porsche designed cars specifically for the tests. Keith Pullen, a professor of energy systems at City, University of London, said that super-fast charging

**The next generation of electric cars could charge their batteries in the time it takes to fill up at a gas station.**

## Gossip

### CHEMWATCH

comes with other drawbacks. "If you charge a battery very quickly, it's less efficient [and] it actually damages the battery," he said. The technology could be useful in an emergency, but frequent use would cause a battery to wear out quickly.

#### Draining the grid

Engineers would need to solve another problem: super-fast chargers use a huge amount of power. Pullen said that a service station with 20 charging stations would use about six megawatts of power — the same amount as a typical small town. "This power has to come from somewhere and it has to come from the grid," he said. "You wouldn't be able to roll this out, there have to be major changes first."

CNN, 13 December 2018

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

## Scientists Are Creating a Laser So Powerful It Could Get a Probe to Mars in Days

2018-12-17

An initiative called Breakthrough Starshot wants to explore another star system using ultra-powerful laser beams and wafer-thin spaceships. It's a goal that sounds so fantastic, you'd be forgiven for dismissing it as science fiction. But it's no joke, and the project's chief engineer says millions of dollars' worth of work is moving along without any major snags. Starshot's founders and collaborators include the late Stephen Hawking, Harvard University astronomer Avi Loeb, and Russian-American billionaire Yuri Milner. The concept is based on more than 80 scientific studies about interstellar travel. Milner and other Silicon Valley investors have even paid US\$100 million to cover the first 10 years of research and development. "They had us go and study a whole range of different approaches of how would we send an object to [another star]," Peter Klupar, the engineering director of the non-profit Breakthrough Foundation and its Starshot initiative, told an audience at the Economist's Space Summit on November 1. "We ended up deciding that the only credible way to do it today was building a large laser based in probably Chile." The project hopes to propel roughly 1,000 tiny "StarChip" spacecraft toward Alpha Centauri, the second-closest star system to Earth, at 20% of light-speed (about 134 million mph). Each "chip" would weigh 1 gram or less. Another destination under consideration is Proxima Centauri, which is even closer to Earth and may have a habitable planet. In either case, StarChips may

**An initiative called Breakthrough Starshot wants to explore another star system using ultra-powerful laser beams and wafer-thin spaceships.**

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start careening out of the solar system in the mid-2030s. Each one would accelerate to its insane cruising speed within minutes, thanks to the mighty laser blast beamed into space from Earth. But Klupar noted that a 100-gigawatt laser “beamer” would be powerful enough to “ignite an entire city in minutes” if it were reflected off a mirror in space and back to Earth. Vaporising cities is not the goal of Starshot, of course. Rather, if the plan works out, camera-wielding StarChips could send humanity the first close-up photos of Earth-size worlds by the 2060s. (The voyage would take about 25 years, then receiving data would take another 4-plus years depending on the destination.) Starshot was unveiled in 2016, and Klupar said work on the project since then has moved right along. “You would think that this is all impossible, but we have folks at Caltech and the University of Southampton and Exeter University working on about 50 contracts on making all [of] this happen,” Klupar said. “No one has come up with a deal-breaker that we can find yet. It all seems real.” Klupar and others are not deluding themselves about Starshot’s many hurdles. Even the project’s own studies regularly make room for dead ends. Some of the internal research frets about the potentially untenable cost of building a laser facility. Other papers analyse the concept of a “light sail”: the device that would need to “catch” the laser beam and convert its energy into motion. Some researchers question whether such a sail would fall apart when faced with the heat or mind-numbing acceleration (about 60,000 times the force of gravity on Earth’s surface). There’s also a risk that the sail could steer a StarChip wildly off-course. “The sail is very thin. It’s about 400 atoms thick, it weighs about a half a gram, and it’s four meters in diameter,” Klupar said. “I think of it as ‘reflective smoke.’” There’s also the pesky issue of gas and dust that lurk between stars; such material could blast a fast-moving spacecraft into robotic Swiss cheese. Nevertheless, Starshot engineers and scientists either see ways around all these issues (such as accepting that a majority of spacecraft won’t make it) or figure that future technological advancements could solve many of the problems within a couple of decades. As an example of demonstrable progress, Klupar highlighted experimental 4-gram satellites, called “sprites,” built and tested by Cornell. In June 2017, a fleet of six sprites rode into space aboard an Indian-built rocket. “This first one was just a stunt just to see if it’d work,” Klupar said. The launch was a success — the sprites used a temperature sensor and relayed the data to Earth along with a radio “beep” signal. Such tiny spacecraft could be seen as a precursor to StarChips, Klupar said. “It feels a lot like the way CubeSats felt 20 years ago,” he said, referring to roughly fist- to breadbox-size spacecraft that are pervasive today. “People were saying, ‘Those are toys, they’re never going to develop into anything, there’s no way I can see that ever working,’” Klupar said. “And today and

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look them: Hundreds of millions of dollars is being spent [on CubeSats].” Starshot aims to launch more 4-gram sprites next year, though with some significant improvements that will be essential to developing a StarChip. We’re going to put cameras on there, and we’re going to start to put all kinds of devices on them,” Klupar said. Klupar said Starshot’s next five years of work is devoted to “learning how to put together these systems so that they actually operate” in the way Starshot envisions them. But before Starshot reaches for the Centauri star systems, it has a much closer target: the solar system. Around the year 2030, the project hopes to build a 1-gigawatt laser-beaming base station somewhere in the Sierra Nevada mountains (assuming it secures more funding). Such a facility would then test the concepts of laser-powered interstellar StarChip missions, but at a cost about 10 times less. The idea is to propel probes past planets, moons, asteroids and more at 1 percent the speed of light. “It turns out that with a 1-gigawatt system and a 10-metre sail, you can get to Mars in days, or get to Jupiter in weeks, or get to Pluto in months,” Klupar said. (By contrast, it took NASA’s New Horizons probe about nine years to reach Pluto.) Klupar estimated the whole effort would cost about \$1 billion, with most of the investment devoted to the laser-beamer. Once that facility is built, though, simple and frequent deep-space exploration could be relatively cheap. According to a preliminary study by a Starshot researcher, each “launch” of a StarChip across the solar system may cost tens of thousands or just thousands of dollars. That estimate assumes optimistic decreases in the cost of lasers, energy, and energy storage, but it’s still far cheaper than the \$1 billion or so typically required to send a robot to another planet. The StarChip variant designed for our solar system would be about 100 grams, Klupar said — about 100 times more massive than the interstellar kind. But he added that launching any StarChip would require many nations to be involved and approve of the effort. That’s because shooting a 1-gigawatt laser into space is not only bright, but could damage passing satellites (which could especially be an issue for planned satellite-internet constellations like SpaceX’s Starlink project.) With the interstellar Starshot effort, the need for global collaboration is even more important. “The 100-gigawatt laser can be seen across the galaxy. It will be brighter than the sun,” Klupar said. Such a powerful laser blast would turn Earth into a brilliant beacon that loudly broadcasts “intelligent life exists here” to any alien civilisation that happens to be staring down the figurative barrel.

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"We're not really doing this just for one group of people," he said. "It's also the whole planet."

Science Alert, 15 December 2018

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

### **A painless adhesive: Adhesives for biomedical applications can be detached with light**

2018-12-17

Researchers from the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) and Xi'an Jiaotong University in China have developed a new type of adhesive that can strongly adhere wet materials—such as hydrogel and living tissue—and be easily detached with a specific frequency of light. The adhesives could be used to attach and painlessly detach wound dressings, transdermal drug delivery devices, and wearable robotics. The paper is published in *Advanced Materials*. "Strong adhesion usually requires covalent bonds, physical interactions, or a combination of both," said Yang Gao, first author of the paper and researcher at Xi'an Jiaotong University. "Adhesion through covalent bonds is hard to remove and adhesion through physical interactions usually requires solvents, which can be time-consuming and environmentally harmful. Our method of using light to trigger detachment is non-invasive and painless." The adhesive uses an aqueous solution of polymer chains spread between two, non-sticky materials—like jam between two slices of bread. On their own, the two materials adhere poorly together but the polymer chains act as a molecular suture, stitching the two materials together by forming a network with the two pre-existing polymer networks. This process is known as topological entanglement. When exposed to ultra-violet light, the network of stitches dissolves, separating the two materials. The researchers, led by Zhigang Suo, the Allen E. and Marilyn M. Puckett Professor of Mechanics and Materials at SEAS, tested adhesion and detachment on a range of materials, sticking together hydrogels; hydrogels and organic tissue; elastomers; hydrogels and elastomers; and hydrogels and inorganic solids. "Our strategy works across a range of materials and may enable broad applications," said Kangling Wu, co-lead author and researcher at Xi'an Jiaotong University in China. While the researchers focused on using UV light to trigger detachment, their work suggests the possibility that the stitching polymer could detach with near-infrared light, a feature which could be applied to a range of new medical procedures. "In nature, wet materials don't like to adhere together," said Suo. "We have discovered a general approach to overcome

**Pulling off a Band-Aid may soon get a lot less painful.**

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this challenge. Our molecular sutures can strongly adhere wet materials together. Furthermore, the strong adhesion can be made permanent, transient, or detachable on demand, in response to a cue. So, as we see it, nature is full of loopholes, waiting to be stitched."

Phys.org, 14 December 2018

<http://phys.org>

### Researchers use jiggly Jell-O to make powerful new hydrogen fuel catalyst

2018-12-17

A cheap and effective new catalyst developed by researchers at the University of California, Berkeley, can generate hydrogen fuel from water just as efficiently as platinum, currently the best—but also most expensive—water-splitting catalyst out there. The catalyst, which is composed of nanometre-thin sheets of metal carbide, is manufactured using a self-assembly process that relies on a surprising ingredient: gelatin, the material that gives Jell-O its jiggle. "Platinum is expensive, so it would be desirable to find other alternative materials to replace it," said senior author Liwei Lin, professor of mechanical engineering at UC Berkeley. "We are actually using something similar to the Jell-O that you can eat as the foundation, and mixing it with some of the abundant earth elements to create an inexpensive new material for important catalytic reactions." The work appears in the Dec. 13 print edition of the journal *Advanced Materials*. A zap of electricity can break apart the strong bonds that tie water molecules together, creating oxygen and hydrogen gas, the latter of which is an extremely valuable source of energy for powering hydrogen fuel cells. Hydrogen gas can also be used to help store energy from renewable yet intermittent energy sources like solar and wind power, which produce excess electricity when the sun shines or when the wind blows, but which go dormant on rainy or calm days. But simply sticking an electrode in a glass of water is an extremely inefficient method of generating hydrogen gas. For the past 20 years, scientists have been searching for catalysts that can speed up this reaction, making it practical for large-scale use. "The traditional way of using water gas to generate hydrogen still dominates in industry. However, this method produces carbon dioxide as by-product," said first author Xining Zang, who conducted the research as a graduate student in mechanical engineering at UC Berkeley. "Electrocatalytic hydrogen generation is growing in the past decade, following the global demand to lower emissions. Developing a highly efficient and low-cost catalyst for electrohydrolysis will bring

**Two-dimensional metal carbides spark a reaction that splits water into oxygen and valuable hydrogen gas.**

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profound technical, economical and societal benefit.”To create the catalyst, the researchers followed a recipe nearly as simple as making Jell-O from a box. They mixed gelatin and a metal ion—either molybdenum, tungsten or cobalt—with water, and then let the mixture dry. “We believe that as gelatin dries, it self-assembles layer by layer,” Lin said. “The metal ion is carried by the gelatin, so when the gelatin self-assembles, your metal ion is also arranged into these flat layers, and these flat sheets are what give Jell-O its characteristic mirror-like surface.” Heating the mixture to 600 degrees Celsius triggers the metal ion to react with the carbon atoms in the gelatin, forming large, nanometre-thin sheets of metal carbide. The unreacted gelatin burns away. The researchers tested the efficiency of the catalysts by placing them in water and running an electric current through them. When stacked up against each other, molybdenum carbide split water the most efficiently, followed by tungsten carbide and then cobalt carbide, which didn’t form thin layers as well as the other two. Mixing molybdenum ions with a small amount of cobalt boosted the performance even more. “It is possible that other forms of carbide may provide even better performance,” Lin said. The two-dimensional shape of the catalyst is one of the reasons why it is so successful. That is because the water has to be in contact with the surface of the catalyst in order to do its job, and the large surface area of the sheets mean that the metal carbides are extremely efficient for their weight. Because the recipe is so simple, it could easily be scaled up to produce large quantities of the catalyst, the researchers say. “We found that the performance is very close to the best catalyst made of platinum and carbon, which is the gold standard in this area,” Lin said. “This means that we can replace the very expensive platinum with our material, which is made in a very scalable manufacturing process.”

Phys.org, 14 December 2018

<http://phys.org>

## For a longer battery life: Pushing lithium ion batteries to the next performance level

2018-12-17

Conventional lithium ion batteries, such as those widely used in smartphones and notebooks, have reached performance limits. Materials chemist Freddy Kleitz from the Faculty of Chemistry of the University of Vienna and international scientists have developed a new nanostructured anode material for lithium ion batteries, which extends the capacity and cycle life of the batteries. Based on a mesoporous mixed metal oxide in

**Scientists have now developed a new nanostructured anode material for lithium ion batteries, which extends the capacity and cycle life of the batteries.**

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combination with graphene, the material could provide a new approach how to make better use of batteries in large devices such as electric or hybrid vehicles. The study has now been published as cover story of the current issue of *Advanced Energy Materials*. High energy density, extended cycle life and no memory effect: Lithium ion batteries are the most widespread energy storage devices for mobile devices as well as bearers of hope for electro mobility. Researchers are looking for new types of active electrode material in order to push the batteries at the next level of high performance and durability, and to make them better usable for large devices. "Nanostructured lithium ion battery materials could provide a good solution," says Freddy Kleitz from the Department of Inorganic Chemistry -- Functional Materials of the University of Vienna, who together with Claudio Gerbaldi, leader of the Group for Applied Materials and Electrochemistry at the Politecnico di Torino, Italy, is the study's main author. The 2D/3D nanocomposite based on a mixed metal oxide and graphene, developed by the two scientists and their teams, seriously enhances the electrochemical performance of lithium ion batteries. "In our test runs, the new electrode material provided significantly improved specific capacity with unprecedented reversible cycling stability over 3,000 reversible charge and discharge cycles even at very high current regimes up to 1,280 milliamperes," says Department Head Freddy Kleitz. Today's lithium ion batteries lose their performance after about 1,000 charging cycles.

### New recipe

Conventional anodes often exist of carbon material such as graphite. "Metal oxides have a better battery capacity than graphite, but they are quite instable and less conductive," explains Kleitz. The researchers found a way to make best use of the positive features of both compounds. They developed a new family of electrode active materials, based on a mixed metal oxide and the highly conductive and stabilizing graphene, showing superior characteristics compared to those of most transition metal oxide nanostructures and composites. As a first step, based on a newly designed cooking procedure, the researchers were able to mix copper and nickel homogeneously and under controlled manner to achieve the mixed metal. Based on nanocasting -- a method to produce mesoporous materials -- they created structured nanoporous mixed metal oxide particles, which due to their extensive network of pores have a very high active reaction area for the exchange with lithium ion from the battery's electrolyte. The scientists then applied a spray drying procedure to wrap the mixed metal oxide particles tightly with thin graphene layers.

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#### Simple and efficient design

The use of lithium ion batteries for e-mobility is considered problematic from an environmental point of view, e.g. due to their raw material-intensive production. Small batteries that can store as much energy as possible, last as long as possible and are not too cost-intensive to manufacture could advance their use in large-scale devices. "Compared to existing approaches, our innovative engineering strategy for the new high-performing and long-lasting anode material is simple and efficient. It is a water-based process and therefore environmentally friendly and ready to be applied to industrial level," the study authors conclude.

Science Daily, 13 December 2018

<http://www.sciencedaily.com>

#### **Scientists identify new minerals for carbon capture**

2018-12-17

Research confirms new minerals are capturing and storing carbon in a new paper by University of Alberta geologists and their collaborators. The minerals, members of the hydrotalcite group, are the first outside of the carbonate family to naturally capture atmospheric CO<sub>2</sub> in mine waste, important as society continues to forge ways to lower our carbon emissions and combat climate change. "This research confirmed that hydrotalcites are capable of sequestering atmospheric CO<sub>2</sub> in mine waste," said Connor Turvey, who conducted this research during his PhD studies under the supervision of Sasha Wilson. "Hydrotalcites are trapping the CO<sub>2</sub> deeper into the tailings where carbonate minerals were unable to form." Mine tailings are composed of the waste minerals removed from the ground in the mining process. As these minerals are exposed to the atmosphere and to rain water, they can react to form new minerals that trap CO<sub>2</sub> from the atmosphere. The research highlights the potential for improving carbon capture one to two metres beneath the surface of mining wastes, where most sequestration usually occurs. "One thing that this indicates is that the capacity for carbon sequestration at this depth could be improved by providing a more plentiful source of carbon to those depths," added Wilson, associate professor in the Department of Earth and Atmospheric Sciences and expert in economic geology. The study was conducted at Woodsreef Asbestos Mine in New South Wales, Australia. Carbon capture, utilisation, and storage in minerals is of growing importance for both academia and industry. This discovery points to the potential to use mineral waste from mines to sequester carbon more

**Research confirms new minerals are capturing and storing carbon.**

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effectively, supporting remediation efforts. "Merely going carbon neutral is no longer going to be enough to prevent climate change from occurring," said Turvey. "What is now needed is for our world to become carbon negative." This means that industry must both reduce carbon emissions while simultaneously exploring carbon sequestration to actively draw excess CO<sub>2</sub> from the atmosphere -- making discoveries like this one more important than ever.

Science Daily, 12 December 2018

<http://www.sciencedaily.com>

### **NYU researchers pioneer machine learning to speed chemical discoveries, reduce waste**

2018-12-17

Machine learning algorithms can predict stock market fluctuations, control complex manufacturing processes, enable navigation for robots and driverless vehicles, and much more. Now, researchers at the NYU Tandon School of Engineering are tapping a new set of capabilities in this field of artificial intelligence, combining artificial neural networks with infrared thermal imaging to control and interpret chemical reactions with precision and speed that far outpace conventional methods. More innovative still is the fact that this technique was developed and tested on novel microreactors that allow chemical discoveries to take place quickly and with far less environmental waste than standard large-scale reactions. "This system can reduce the decision-making process about certain chemical manufacturing processes from one year to a matter of weeks, saving tons of chemical waste and energy in the process," said Ryan Hartman, an assistant professor of chemical and biomolecular engineering at NYU Tandon and lead author of a paper detailing the method in the journal *Computers & Chemical Engineering*. Last year, Hartman introduced a new class of miniaturized chemical reactors that brings reactions traditionally carried out in large-batch reactors with up to 100 litres of chemicals down to the microscale, using just microlitres of fluid - a few small drops. These microfluidic reactors are useful for analysing catalysts for manufacturing or discovering compounds and studying interactions in drug development, and they promise to reduce waste, speed innovation, and improve the safety of chemical research. Hartman and his team have increased the utility of these reactors by pairing them with two additional technologies: infrared thermography, an imaging technique that captures a thermal map displaying changes in heat during a chemical reaction, and supervised machine learning, a discipline of artificial intelligence

**First-of-its-kind system pairs artificial neural networks with infrared imaging to run small-scale chemical reactions with big impact.**

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wherein an algorithm learns to interpret data based on inputs selected by researchers controlling the experiments. Paired together, they allow researchers to capture changes in thermal energy during chemical reactions -- as indicated by colour changes on the thermal image -- and to interpret these changes quickly. Due to the non-contact nature of infrared thermography, the technique can even be utilized for reactions that operate at extreme temperatures or in extreme conditions, such as a bioreactor that requires a sterile field. The research team is the first to train an artificial neural network to control and interpret infrared thermal images of a thermoelectrically cooled microfluidic device. The potential impacts on both innovation and sustainability are significant. Large chemical companies may screen hundreds of catalysts while developing new polymers, for example, and each reaction can require more than 100 litres of chemicals and 24 hours or longer. Screening that number of catalysts using current laboratory processes can take a year. Using Hartman's approach, the entire process can be accomplished in weeks, with exponentially less waste and energy usage. Hartman estimates that a single industrial hood used to control fumes during large-scale chemical testing uses as much energy per year as the average U.S. home.

EurekAlert, 13 December 2018

<http://www.eurekalert.org>

### Gold recycling

2018-12-17

"Urban mining", the recycling of precious metals from electronic gadgets, becomes ever more important, although processes that are both efficient and environmentally benign are still scarce. An international team of scientists has now looked deeper into gold dissolution, in particular, how organic thiol-containing compounds help dissolve elemental gold. Their study published in the journal *Angewandte Chemie* proposes selective, fast, and convenient thiol-assisted gold leaching processes. The traditional way of recycling gold "waste" is melting: dental gold and jewellery can be recycled close to 100 %. Recycling of precious metals in smartphones, computers, and other electronic gadgets is much harder, and the recovery quote is still low. Despite their abundance in electronic devices, their relative content is still too low to allow for really economical urban mining. The traditional mining method for gold is hydrometallurgical cyanide leaching, which produces a vast amount of hazardous waste while being relatively unselective. More recent concepts rely on the complexation of gold in organic solutions because forms soluble complexes with sulfur-

**Selective dissolution of elemental gold from multi-metal sources in organic solutions**

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containing reagents. However, the processes must be feasible on a large scale and still avoid toxic or hazardous compounds. Now, Timo Repo at the University of Helsinki, Finland, and his colleagues have looked deeper into the details of selective gold extraction in organic solution. They propose an efficient gold recovery method from electronic waste with pyridinethiols and hydrogen peroxide as reagents, the chemical dimethyl formamide as organic solvent, and, optionally, elemental sulfur to reduce the reagent load. Pyridinethiol is pyridine, a nitrogen-containing aromatic ring, with a thiol group, SH, added to its ring. The reagent not only binds elemental gold to form soluble complexes, but the complex has also a favourable linear structure formed by two pyridinethiol molecules on either side of the gold atom. Upon oxidation, it transforms to a stable cationic gold-containing product in organic solution. This complex formation with two ligands is a specialty of gold, favouring the energetics of dissolution and oxidation. Accordingly, the authors reported nearly quantitative dissolution of gold from powder, film, or electronic boards after 20 minutes extraction time. But how can gold dissolution be distinguished from that of other precious metals? In contrast to gold having a one-electron oxidation, platinum and palladium require two-electron oxidations and thus are not accessible with this method. In contrast, both copper and silver form complexes with pyridinethiols, although not as effective as gold. Therefore, before dissolving the gold from the "gold finger" region in a printed circuit board, the scientists first extracted copper and silver with ammonia and sulfate-containing solutions, which are established methods. Looking into the exact mechanism of thiol-assisted gold dissolution, the scientists discovered a surprisingly high variety of sulfur-containing side products. Some of them seemed to be crucial for proceeding the oxidation reaction, for example S(8), a common form of elemental sulfur. This also proved to be an asset: By adding external S(8), the ligand load could be reduced, reported the authors. Their extraction method could mark a new basis for more efficient urban mining.

EurekaAlert, 13 December 2018

<http://www.eurekalert.org>

### **An energy-efficient way to stay warm: Sew high-tech heating patches to your clothes**

2018-12-17

What if, instead of turning up the thermostat, you could warm up with high-tech, flexible patches sewn into your clothes - while significantly

**Personal patches could reduce energy waste in buildings, Rutgers-led study says**

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reducing your electric bill and carbon footprint? Engineers at Rutgers and Oregon State University have found a cost-effective way to make thin, durable heating patches by using intense pulses of light to fuse tiny silver wires with polyester. Their heating performance is nearly 70 percent higher than similar patches created by other researchers, according to a Rutgers-led study in *Scientific Reports*. They are inexpensive, can be powered by coin batteries and are able to generate heat where the human body needs it since they can be sewed on as patches. "This is important in the built environment, where we waste lots of energy by heating buildings - instead of selectively heating the human body," said senior author Rajiv Malhotra, an assistant professor in the Department of Mechanical and Aerospace Engineering at Rutgers University-New Brunswick. The department is in the School of Engineering. It is estimated that 47 percent of global energy is used for indoor heating, and 42 percent of that energy is wasted to heat empty space and objects instead of people, the study notes. Solving the global energy crisis - a major contributor to global warming - would require a sharp reduction in energy for indoor heating. Personal thermal management, which focuses on heating the human body as needed, is an emerging potential solution. Such patches may also someday help warm anyone who works or plays outdoors. The Rutgers and Oregon State engineers created highly efficient, flexible, durable and inexpensive heating patches by using "intense pulsed-light sintering" to fuse silver nanowires - thousands of times thinner than a human hair - to polyester fibres, using pulses of high-energy light. The process takes 300 millionths of a second, according to the study funded by the National Science Foundation and Walmart U.S. Manufacturing Innovation Fund. When compared with the current state of the art in thermal patches, the Rutgers and Oregon State creation generates more heat per patch area and is more durable after bending, washing and exposure to humidity and high temperature. Next steps include seeing if this method can be used to create other smart fabrics, including patch-based sensors and circuits. The engineers also want to determine how many patches would be needed and where they should be placed on people to keep them comfortable while reducing indoor energy consumption.

EurekaAlert, 13 December 2018

<http://www.eurekaalert.org>

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### Scientists discover stability in hybrid photoelectric nanomaterials

2018-12-17

A team of Siberian scientists and foreign colleagues calculated the parameters that influence the intensity of the reaction between carbon nanotubes and phthalocyanines—complex nitrogen-containing compounds. Hybrid constructions based on them are considered as new materials for solar cell batteries, sensors and optic devices. The work was published in Applied Surface Science. Many new materials for photoelectric devices combine two non-organic and organic chemical elements. The first may be represented by carbon nanotubes—hollow cylinders with walls made of hexagons with atoms of carbon at vertexes. The organic part may be comprised of heterocyclic compounds such as phthalocyanines. These substances consist of several carbon rings bound with nitrogen atoms and are able to form complexes with metals. This combination is not arbitrary: Cyclic molecules donate electrons, and carbon nanostructures accept them. Continuous transitions secure electrical conductivity in a photoelectric material. “One of the issues with hybrids like that is low stability of the chemical bond between the organic and non-organic parts. As a result, phthalocyanines become quite mobile on the surface of carbon nanotubes. This is a disadvantage, as in this case, certain properties are not attributed to the material homogeneously,” said Pavel Krasnov, a senior research associate at the Institute for Nanotechnologies, Spectroscopy, and Quantum Chemistry, Siberian Federal University. In the course of the work, the scientists considered the dependence of nanotubes-phthalocyanines bond stability on a number of parameters, such as diameter and form of the carbon nanostructure, nature of the metal forming a complex with the organic component, and so on. As the result of the quantum-mechanical modelling, the researchers found which parameters should be changed and how to increase bond stability to its maximum. The chemists discovered that the position of a phthalocyanine molecule relative to a tube was an important factor. The strongest bond was observed when a cross-shaped organic molecule “hugged” the cylinder, like a sloth hugging a thick branch. The type of a metal that forms a complex with phthalocyanine also plays an important role: In the cobalt-zinc-copper range the bond strength decreases. Another interesting relation was discovered between the orientation of the grid of hexagons and its size. For nanotubes with diameter less than 10.5 Å (one angstrom is 10<sup>-10</sup>m), the most stable bond is formed in the case of an “armchair” configuration when the connections of hexagons in the grid that are perpendicular to the axis of the tube are chair-shaped.

**A team of Siberian scientists and foreign colleagues calculated the parameters that influence the intensity of the reaction between carbon nanotubes and phthalocyanines—complex nitrogen-containing compounds.**

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In case of bigger diameter, the most advantageous shape is “zigzag.” “The discovered relations will help to create target hybrid nanostructures with the highest binding capacity between carbon nanotubes and phthalocyanines. These materials may be used in many areas, but their main purpose is photoelectronics,” concludes Pavel Krasnov.

Phys.org, 12 December 2018

<http://phys.org>

### Sun-soaking device turns water into superheated steam

2018-12-17

MIT engineers have built a device that soaks up enough heat from the sun to boil water and produce “superheated” steam hotter than 100 degrees Celsius, without any expensive optics. On a sunny day, the structure can passively pump out steam hot enough to sterilise medical equipment, as well as to use in cooking and cleaning. The steam may also supply heat to industrial processes, or it could be collected and condensed to produce desalinated, distilled drinking water. The researchers previously developed a sponge-like structure that floated in a container of water and turned the water it absorbed into steam. But a big concern is that contaminants in the water caused the structure to degrade over time. The new device is designed to be suspended over the water, to avoid any possible contamination. The suspended device is about the size and thickness of a small digital tablet or e-reader, and is structured like a sandwich: The top layer is made from a material that efficiently absorbs the sun’s heat, while the bottom layer efficiently emits that heat to the water below. Once the water reaches the boiling point (100 C), it releases steam that rises back up into the device, where it is funnelled through the middle layer -- a foam-like material that further heats the steam above the boiling point, before it’s pumped out through a single tube. “It’s a completely passive system -- you just leave it outside to absorb sunlight,” says Thomas Cooper, assistant professor of mechanical engineering at York University, who led the work as a postdoc at MIT. “You could scale this up to something that could be used in remote climates to generate enough drinking water for a family, or sterilize equipment for one operating room.” The team’s results are detailed in a paper to be published in Nature Communications. The study includes researchers from the lab of Gang Chen, the Carl Richard Soderberg Professor of Power Engineering at MIT.

A clever combination

**High-temperature steam might be used in remote regions to cook, clean, or sterilise medical equipment**

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In 2014, Chen's group reported the first demonstration of a simple, solar-driven steam generator, in the form of a graphite-covered carbon foam that floats on water. This structure absorbs and localises the sun's heat to the water's surface (the heat would otherwise penetrate down through the water). Since then, his group and others have looked to improve the efficiency of the design with materials of varying solar-absorbing properties. But almost every device has been designed to float directly on water, and they have all run into the problem of contamination, as their surfaces come into contact with salt and other impurities in water. The team decided to design a device that instead is suspended above water. The device is structured to absorb short-wavelength solar energy, which in turn heats up the device, causing it to reradiate this heat, in the form of longer-wavelength infrared radiation, to the water below. Interestingly, the researchers note that infrared wavelengths are more readily absorbed by water, versus solar wavelengths, which would simply pass right through. For the device's top layer, they chose a metal ceramic composite that is a highly efficient solar absorber. They coated the structure's bottom layer with a material that easily and efficiently emits infrared heat. Between these two materials, they sandwiched a layer of reticulated carbon foam -- essentially, a sponge-like material studded with winding tunnels and pores, which retains the sun's incoming heat and can further heat up the steam rising back up through the foam. The researchers also attached a small outlet tube to one end of the foam, through which all the steam can exit and be easily collected. Finally, they placed the device over a basin of water and surrounded the entire set-up with a polymer enclosure to prevent heat from escaping. "It's this clever engineering of different materials and how they're arranged that allows us to achieve reasonably high efficiencies with this noncontact arrangement," Cooper says.

#### Full steam ahead

The researchers first tested the structure by running experiments in the lab, using a solar simulator that mimics the characteristics of natural sunlight at varying, controlled intensities. They found that the structure was able to heat a small basin of water to the boiling point and produce superheated steam, at 122 C, under conditions that simulated the sunlight produced on a clear, sunny day. When the researchers increased this solar intensity by 1.7 times, they found the device produced even hotter steam, at 144 C. On 21 October 2017, they tested the device on the roof of MIT's Building 1, under ambient conditions. The day was clear and bright, and to increase the sun's intensity further, the researchers constructed a simple solar concentrator -- a curved mirror that helps to collect and

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redirect more sunlight onto the device, thus raising the incoming solar flux, similar to the way a magnifying glass can be used to concentrate a sun's beam to heat up a patch of pavement. With this added shielding, the structure produced steam in excess of 146 C over the course of 3.5 hours. In subsequent experiments, the team was able to produce steam from sea water, without contaminating the surface of the device with salt crystals. In another set of experiments, they were also able to collect and condense the steam in a flask to produce pure, distilled water. Chen says that, in addition to overcoming the challenges of contamination, the device's design enables steam to be collected at a single point, in a concentrated stream, whereas previous designs produced more dilute spray. "This design really solves the fouling problem and the steam collection problem," Chen says. "Now we're looking to make this more efficient and improve the system. There are different opportunities, and we're looking at what are the best options to pursue."

Science Daily, 11 December 2018

<http://www.sciencedaily.com>

### Your phone could work at extreme temps with new plastic

2018-12-17

Researchers have created a new kind of plastic material that could help electronics function in extreme heat. The new plastic material could reliably conduct electricity in up to 220 degrees Celsius (428 F), according to a paper in Science. "Commercial electronics operate between minus 40 and 85 degrees Celsius. Beyond this range, they're going to malfunction," says Jianguo Mei, an assistant professor of organic chemistry at Purdue University. "We created a material that can operate at high temperatures by blending two polymers together." One of these is a semiconductor, which can conduct electricity, and the other is a conventional insulating polymer, which is what you might picture when you think of regular plastic. To make this technology work for electronics, the researchers couldn't just meld the two together—they had to tinker with ratios. "One of the plastics transports the charge, and the other can withstand high temperatures," says Aristide Gumyusenge, a graduate researcher and lead author of the paper. "When you blend them together, you have to find the right ratio so that they merge nicely and one doesn't dominate the other." The researchers discovered a few properties that are essential to make this work. The two materials need to be compatible to mix and each should be present in roughly the same ratio. This results in an

**Researchers have created a new kind of plastic material that could help electronics function in extreme heat.**

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organised, interpenetrating network that allows the electrical charge to flow evenly throughout while holding its shape in extreme temperatures. The most impressive thing about this new material isn't its ability to conduct electricity in extreme temperatures, but that its performance doesn't seem to change. Usually, the performance of electronics depends on temperature—think about how fast your laptop would work in your climate-controlled office versus the Arizona desert. The performance of this new polymer blend remains stable across a wide temperature range. Extreme-temperature electronics might be useful for scientists in Antarctica or travellers wandering the Sahara, but they're also critical to the functioning of cars and planes everywhere. In a moving vehicle, the exhaust is so hot that sensors can't be too close and fuel consumption must be monitored remotely. If sensors could be directly attached to the exhaust, operators would get a more accurate reading. This is especially important for aircraft, which have hundreds of thousands of sensors. "A lot of applications are limited by the fact that these plastics will break down at high temperatures, and this could be a way to change that," says Brett Savoie, an assistant professor of chemical engineering. "Solar cells, transistors, and sensors all need to tolerate large temperature changes in many applications, so dealing with stability issues at high temperatures is really critical for polymer-based electronics." The researchers will conduct further experiments to figure out what the true temperature limits are (high and low) for their new material. Making organic electronics work in the freezing cold is even more difficult than making them work in extreme heat, Mei says. Awards from the Purdue University Startup fund, the Office of Naval Research Young Investigator Program, and the National Science Foundation CAREER program funded the work.

Futurity, 13 December 2018

<http://www.futurity.org>

## **Boron nitride and silver nanoparticles to help get rid of carbon monoxide**

2018-12-17

Russian chemists from NUST MISIS have developed a new hybrid catalyst for carbon monoxide oxidation consisting of hexagonal boron nitride and silver nanoparticles. This material makes it possible to get a full conversion of carbon monoxide at only 194 degrees Celsius. As stated in the *Journal of Catalysis*, this temperature is nowhere near the process's record temperatures, but in the future, chemists can reduce the temperature of catalysis more by increasing the concentration of

**Russian chemists from NUST MISIS have developed a new hybrid catalyst for carbon monoxide oxidation consisting of hexagonal boron nitride and silver nanoparticles.**

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silver in the hybrid material. Carbon monoxide (carbonous oxide) is one of the most harmful gases to people, but the gas is everywhere as it is released through car engine exhaust. Catalytic converters, which oxidise the gas to non-toxic nitrogen dioxide through catalytic reactions, are typically used to get rid of cars' carbon monoxide exhaust. However, due to the increase in the efficiency of modern engines and a decrease in the temperature of the exhaust gases, catalysts have dramatically lost efficiency and as a result, carbon monoxide content has increased in them. To fight this effect, chemists are actively looking for new types of catalysts for CO oxidation that can work at relatively low temperatures—around 150-200 degrees Celsius. American scientists have recently developed a catalyst for the carbon monoxide oxidation of individual platinum atoms distributed over the surface of cerium oxide. Some materials have allowed scientists to oxidise CO with a lower rate of conversion at temperatures below 100 degrees. A group of chemists from Russia and Australia led by NUST MISIS's Professor Dmitri V. Golberg has discovered a new effective catalyst that can be used to convert carbon monoxide. Scientists had previously shown that hybrid materials based on hexagonal boron nitride and silver nanoparticles are promising for this purpose. Similar materials, where boron nitride served as a carrier matrix for metal nanoparticles of the catalyst, have also been proposed, including for carbon monoxide oxidation, but gold and platinum were previously thought to be the best metals to conduct oxidation. It turns out that hybrid materials with cheaper silver nanoparticles are also a very effective catalyst. To obtain these silver nanoparticles, researchers used the decomposition reaction of silver nitrate under the effect of ultraviolet light in a solution of polyethylene glycol. This approach allows scientists to obtain monodisperse silver particles up to 10 nanometres in size, which are uniformly deposited on the surface of layered boron nitride and on the polymer matrix of polyethylene glycol. Materials with the maximum concentration of silver nanoparticles, which amounted to about 1.4 percent by weight, turned out to be the most effective. Such a hybrid catalyst allows carbon monoxide to be oxidized to carbon dioxide at a temperature of just 194 degrees Celsius. This number is still far from record values, but according to the researchers, in the future the temperature of the catalyst's work can be reduced further by increasing the concentration of silver nanoparticles, and in particular, by transforming them from the polymer matrix to boron nitride. However, scientists do note that the current parameters of the catalyst only make it possible to use them to clean things like factories emitting harmful emissions. In the future, by reducing the temperature of the carbon monoxide conversion, these materials can also be used to reduce the ratio of carbon monoxide in

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vehicle emissions. The development of catalysts for the oxidation of carbon monoxide to carbon dioxide is relevant for the purification of harmful emissions as well as catalysts for other gas reactions—such as those to handle the decomposition of methane or to reduce carbon dioxide to hydrocarbons. Scientists around the globe are developing these catalysts to solve a number of technological and ecological issues.

Phys.org, 13 December 2018

<http://phys.org>

### Ingestible capsule can be controlled wirelessly

2018-12-17

Researchers at MIT, Draper, and Brigham and Women's Hospital have designed an ingestible capsule that can be controlled using Bluetooth wireless technology. The capsule, which can be customised to deliver drugs, sense environmental conditions, or both, can reside in the stomach for at least a month, transmitting information and responding to instructions from a user's smartphone. The capsules, manufactured using 3-D-printing technology, could be deployed to deliver drugs to treat a variety of diseases, particularly in cases where drugs must be taken over a long period of time. They could also be designed to sense infections, allergic reactions, or other events, and then release a drug in response. "Our system could provide closed-loop monitoring and treatment, whereby a signal can help guide the delivery of a drug or tuning the dose of a drug," says Giovanni Traverso, a visiting scientist in MIT's Department of Mechanical Engineering, where he will be joining the faculty in 2019. These devices could also be used to communicate with other wearable and implantable medical devices, which could pool information to be communicated to the patient's or doctor's smartphone. "We are excited about this demonstration of 3-D printing and of how ingestible technologies can help people through novel devices that facilitate mobile health applications," says Robert Langer, the David H. Koch Institute Professor and a member of MIT's Koch Institute for Integrative Cancer Research. Langer and Traverso are the senior authors of the study, which appears in the Dec. 13 issue of *Advanced Materials Technologies*. Yong Lin Kong, a former MIT postdoc who is now an assistant professor at the University of Utah, is the paper's lead author.

#### Wireless communication

For the past several years, Langer, Traverso, and their colleagues have been working on a variety of ingestible sensors and drug delivery capsules,

**Electronic pill can relay diagnostic information or release drugs in response to smartphone commands**

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which they believe would be useful for long-term delivery of drugs that currently have to be injected. They could also help patients to maintain the strict dosing regimens required for patients with HIV or malaria. In their latest study, the researchers set out to combine many of the features they had previously developed. In 2016, the researchers designed a star-shaped capsule with six arms that fold up before being encased in a smooth capsule. After being swallowed, the capsule dissolves and the arms expand, allowing the device to lodge in the stomach. Similarly, the new device unfolds into a Y-shape after being swallowed. This enables the device to remain the stomach for about a month, before it breaks into smaller pieces and passes through the digestive tract. One of these arms includes four small compartments that can be loaded with a variety of drugs. These drugs can be packaged within polymers that allow them to be released gradually over several days. The researchers also anticipate that they could design the compartments to be opened remotely through wireless Bluetooth communication. The device can also carry sensors that monitor the gastric environment and relay information via a wireless signal. In previous work, the researchers designed sensors that can detect vital signs such as heart rate and breathing rate. In this paper, they demonstrated that the capsule could be used to monitor temperature and relay that information directly to a smartphone within arm's length. "The limited connection range is a desirable security enhancement," Kong says. "The self-isolation of wireless signal strength within the user's physical space could shield the device from unwanted connections, providing a physical isolation for additional security and privacy protection." To enable the manufacturing of all of these complex elements, the researchers decided to 3-D print the capsules. This approach allowed them to easily incorporate all of the various components carried by the capsules, and to build the capsule from alternating layers of stiff and flexible polymers, which helps it to withstand the acidic environment of the stomach. "Multimaterials 3-D printing is a highly versatile manufacturing technology that can create unique multicomponent architectures and functional devices, which cannot be fabricated with conventional manufacturing techniques," Kong says. "We can potentially create customised ingestible electronics where the gastric residence period can be tailored based on a specific medical application, which could lead to a personalised diagnostic and treatment that is widely accessible."

#### Early response

The researchers envision that this type of sensor could be used to diagnose early signs of disease and then respond with the appropriate

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medication. For example, it could be used to monitor certain people at high risk for infection, such as patients who are receiving chemotherapy or immunosuppressive drugs. If infection is detected, the capsule could begin releasing antibiotics. Or, the device could be designed to release antihistamines when it detects an allergic reaction. "We're really excited about the potential for gastric resident electronics to serve as platforms for mobile health to help patients remotely," Traverso says. The current version of the device is powered by a small silver oxide battery. However, the researchers are exploring the possibility of replacing the battery with alternative power sources, such as an external antenna or stomach acid. The researchers are also working on developing other kinds of sensors that could be incorporated into the capsules. In this paper, they tested the temperature sensor in pigs, and they estimate that within about two years, they may be able to start testing ingestible sensors in human patients. They have launched a company that is working on developing the technology for human use.

EurekAlert, 13 December 2018

<http://www.eurekalert.org>

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### Humans Are Pooping Plastic, And No One's Certain How Bad That Is

2018-12-12

When Philipp Schwabl asked eight healthy people on four continents to take part in an experiment to see if plastic was present in their bodies, he had little idea what to expect. The Medical University of Vienna researcher, who specialises in stomach disorders, asked them to keep a food diary for a week and record whether they had drunk water from plastic bottles, what brands of toothpaste and cosmetics they had used, and whether they had chewed gum. None were vegetarian, all had consumed plastic-wrapped food and most had consumed fish. They were then asked to send a piece of their stool to an Austrian government laboratory where it was tested to identify barely visible microplastic particles, which are smaller than 5 millimetres long. The study, published in August, confirmed for the first time that microplastics are deep inside humans. All eight volunteers were found to have particles of most of the nine most common classes of plastics, including polypropylene and PET. On average, Schwabl found 20 particles per 10 grams of stool. "I did not think all the samples would be positive," Schwabl said. "There is data on microplastics being present in shrimps, fish, oysters and mussels, but there was a question over whether they were present in humans. It is highly likely that during various steps of food processing or as a result of packaging, food is being contaminated with plastics." "The smallest particles are capable of entering the bloodstream, the lymphatic system and may even reach the liver," he added. "We need further research to understand what this may mean for human health." A clutch of studies looking at large plastic fragments in oceans has recently shown the world's most ubiquitous material to be present from the poles to the equator and to be a growing environmental hazard. Plastic in marine environments is now widely recognised to be a threat to many marine species. The new awareness of plastic pollution is leading scientists to ask afresh how much the human body is being polluted. Global plastic production has increased from 16.5 million tons a year in the 1960s to over 364 million tons a year now and is expected to triple by 2050. Studies have found plastic fibres and fragments present throughout the food chain, in plankton and fish larvae, bottled and tap water, seafoods, honey and salt. One analysis of 259 water bottles from 19 places in nine countries found an average of 325 plastic particles in every litre of water. One widely sold brand had concentrations of about 10,000 particles per litre, and only 17 of the 259 bottles contained water that was free of plastic. Other research has shown plastic particles shed from degrading car tires present in the air we breathe in the street, in

**There's a frightening lack of research about plastic's effects on human health.**

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homes from the washing of synthetic clothes, and in the soil via sludge from water treatment works that is used as a fertiliser. With global plastic production increasing from 16.5 million tons a year in the 1960s to over 364 million tons a year now and expected to triple by 2050, research is needed to gauge what effect growing human exposure to it may be having, say scientists. "Plastic is non-degradable. It cannot be broken down and has the potential to persist in our bodies for a lifetime after exposure," said Stephanie Wright, a researcher at University College London who specialises in microscopic plastic pollution. Concern is growing that many man-made chemicals added to consumer plastics to give them qualities like stiffness or transparency may contain hormone-altering chemicals that have barely been tested. According to one study, detectable levels of bisphenol A, one of a group of toxic chemicals, have been found in the urine of 95 percent of the adult population of the U.S. People working in the textile industry have been shown to develop lung disease after exposure to nylon (plastic) flock, said Wright. "Continuous daily interaction with plastic allows oral, dermal [skin] and inhalation exposure to chemical components. The potential for microplastics and nanoplastics so small they cannot be seen by the naked eye to cause harm to human health remains understudied," she said. Michael Warhurst, director of European chemical watchdog group CHEM Trust, has, with academics, identified over 4,000 chemicals potentially present in plastic packaging, of which 63 have been identified as dangerous to human health because of their potential to disrupt hormones. "Many chemicals used in plastics have not been tested for their endocrine-disrupting effects," Warhurst said. "Current test methods are not very good at identifying all of them." Some of the most common are bisphenols and phthalates, used in everything from food packaging and toys to floor tiles and water bottles. They have been connected to childhood obesity, asthma, cardiovascular diseases and even cancers. Many countries have either banned bisphenol A or advised that it may be dangerous to children. The United States' National Toxicology Program has "some concern" for bisphenol A's effect on the brain, behaviour and prostate gland in foetuses, infants and children. It is still used widely in Europe. But other bisphenols and phthalates are not banned and are used frequently in the production of consumer goods. Many, said Warhurst, may be similar or even more toxic than those banned. "A lot of chemicals are very similar to known endocrine disruptors. When one gets banned, there are others behind it. Chemical companies are required to provide data but it's not always comprehensive. There is no strict enforcement and companies can bring chemicals onto the market easily. More research is needed and much better control," he said. Other scientists have said the danger to human health, if any, may be in

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the smallest pieces, or nanoplastics. "Microplastics will not enter a cell, but nanoplastics are small enough to cross into cells and permeate the body," said Anne Marie Mahon, a researcher at the Galway-Mayo Institute of Technology in Ireland. Her recent research found sludge in water treatment works full of microparticles. "It's possible that chemicals could be absorbed in our circulatory system or pass into our organs. But whether that is happening is unknown," Mahon said. In sufficient concentrations, chemicals can injure and kill cells in the human body, said Frank Kelly, chair of environmental health at King's College London and one of Britain's leading authorities on air pollution. He wrote with Stephanie Wright: "The cells may be replaced successfully or they may not. If inhaled or ingested, microplastics may accumulate and exert localized toxicity by inducing an immune response." Their research is backed by Philipp Schwabl in Austria. "In animals, some microparticles have been found in the liver and embedded in tissue," he said. "Depending on the amount, this could cause immune reactions. It's possible that the minutest particles are in the human blood and tissue but it's very hard to measure and we cannot prove it yet." "We urgently need more research," he added.

Huffington Post, 8 December 2018

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

**Toxic chemicals in your home could be linked to cancer, autism, and reproductive issues. Here are 4 of the most concerning.**

2018-12-18

Homes are laden with synthetic chemicals found in building materials and consumer products. We asked an environmental health expert to identify the chemicals that should be of greatest concern to homeowners and consumers. While science is still learning about the effects of synthetic chemicals, the evidence suggests some of them can contribute to cancer, developmental defects, and reproductive issues. As daunting as the problem may seem, there are many simple ways to protect ourselves from these hazards. The California wildfires destroyed thousands of homes across the state, leaving behind an even greater share of displaced residents. Though the flames have now subsided, locals are left with a lingering environmental threat: the presence of hazardous chemicals. As the homes began to burn, so did the items inside: things like phthalate-filled air fresheners, couches manufactured with flame retardant, and Teflon pans made with harmful PFCs. These chemicals are linked to a

**Homes are laden with synthetic chemicals found in building materials and consumer products.**

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number of adverse health effects, including cancer, developmental defects, and reproductive issues. It's not just fire victims who are at risk. Each day, homeowners are exposed to these chemicals in the form of building materials or consumer products. To find out which are the most dangerous, Business Insider spoke with Dr. Leonardo Trasande, an NYU professor and expert in children's environmental health. "There is increasing and accelerating evidence that synthetic chemicals commonly found in the home contribute to disease and disability," said Trasande. Right now, he said, the evidence is strongest among children, whose bodies are still developing and whose metabolic pathways haven't built up immunity to environmental hazards. Children also weigh less, so their exposure can be higher. Trasande identified the following types of household chemicals as some of the most toxic to humans.

#### Pesticides

- Where they reside: Pesticides are commonly found in fruits, vegetables, potatoes, and milk, among other foods. The non-profit Environmental Working Group even discovered what they considered to be harmful levels of weed-killer – a common pesticide – in Cheerios and Quaker Oats products (There's been some debate about whether these low levels are actually toxic.)
- The potential health effects: While scientists are still figuring out the link between pesticides and human disease, studies have indicated that exposure to certain pesticides may cause cancers like leukaemia and non-Hodgkin lymphoma. Pesticides have also been linked to autism risk in infants and attention deficit hyperactivity disorder (ADHD) in children and young teens.
- How to limit exposure: Trasande said there are a few simple steps people can take to limit their exposure, like not spraying pesticides in their backyards. He also recommended switching to organic foods when possible, though even organic produce can also contain pesticides.

#### Phthalates

- Where they reside: Phthalates are part of the plasticiser family, which make plastic durable and flexible. Although Congress instituted a federal ban on phthalates in toys and children's products in 2008, the chemicals continue to be used in manufacturing. As of 2016, phthalates still represented a third of the plasticiser market. Among the long list of products containing phthalates are items like vinyl flooring,

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shower curtains, detergents, nail polish, hair sprays, shampoos, and perfumes.

- The potential health effects: Trasande said phthalates are associated with a number of reproductive issues, including decreased reproductive functions in men and endometriosis in women. Additional studies have found a link between phthalates and obesity, ADHD, asthma, diabetes, and breast cancer.
- How to limit exposure: Reducing exposure to phthalates is a challenge, given how many products contain the chemical. One helpful trick is to look for key words on the label. If a product was packaged in “recycling-code-3” plastic or contains the word “fragrance,” phthalates could be present.

#### Bisphenol A (BPA)

- Where it resides: Bisphenol A, or BPA, is a chemical commonly found in plastics such as water bottles and food packaging. It's also hidden in household items like paper receipts and the linings of aluminium cans.
- The potential health effects: Numerous scientists, including Trasande, have uncovered a link between BPA and obesity. The chemical has also been associated with coronary artery disease, increased blood pressure, and issues with female reproductive development. While the US Food and Drug Administration (FDA) has said that BPA is safe for humans, their assertion has been widely challenged by the scientific community.
- How to limit exposure: To avoid BPA exposure, Trasande said, homeowners should stop microwaving plastic, scale back on canned food consumption, and replace plastic containers with an alternative like glass or stainless steel.

#### Flame Retardant

- Where they reside: As the name suggests, flame retardants are designed to make products like electronics, furniture, carpets, and building materials less flammable. To date, 13 states have adopted policies that limit or ban flame retardants from certain products. But the chemicals still linger in the environment in soil, water, and air. They're also commonly found in household dust.
- The potential health effects: Flame retardants have been associated with a litany of negative health effects, including thyroid cancer, ADHD, slower brain development, and decreases in children's IQs. Flame retardants in indoor dust could also cause allergies and asthma.

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- How to limit exposure: Frequent mopping and vacuuming can help reduce the likelihood of inhaling dust laced with flame retardant. Parents should also watch out for mattresses and children's toys that contain polyurethane foam.

As science uncovers more evidence of the dangers of these chemicals, the US Environmental Protection Agency (EPA) continues to lag behind. Thus far, the EPA has only banned a handful of chemicals, despite the presence of 80,000 on the US market. Trasande called the EPA's framework for evaluating toxicity "over-simplified and "limited on a number of levels." "We're recognising that low-level exposure to an array of synthetic chemicals commonly used in our household products contributes to these diseases," Trasande said. "What little we know suggests broad consequences."

Business Insider, 6 December 2018

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

## Sculptor Unknowingly Poisons Herself with Her Own Art

2018-12-18

When a sculptor in Toronto started feeling ill in 2013, she had no idea that her art was the reason why. The sculptor, Gillian Genser, had been using blue mussel shells in her sculptures for the past 15 years, and, as a result, unknowingly poisoning herself. The culprit? Heavy metals, including arsenic and lead, found in the mussel shells. In a moving personal essay published Nov. 28 in Toronto Life, Genser described the onset of her symptoms — which began with agitation, headaches and vomiting, and later progressed to symptoms such as hearing loss in one ear and short-term memory problems. It took two-year- for doctors to nail down the diagnosis of heavy metal poisoning. Indeed, Genser wrote, it wasn't until she visited the Royal Ontario Museum in Toronto and spoke with a curator of invertebrates that she put the pieces together. The curator told Genser that toxins can build up in the shells of invertebrates, leading her to research blue mussels. As Live Science has previously reported, chemicals accumulate in mussels as they filter feed, making them good barometers for water pollutants. Genser wrote that, in her case, the mussels she had been working with likely came from water contaminated with industrial waste. After 15 years of working with the mussel shells, she had built up high levels of arsenic and lead in her blood. She will "never fully recover" and continues to live with many symptoms, she wrote. However, she

**When a sculptor in Toronto started feeling ill in 2013, she had no idea that her art was the reason why.**

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went on to complete her mussel-sculpture, a depiction of the biblical Adam, in 2015. She calls him her "beautiful death." Heavy-metal poisoning occurs when too much of a heavy metal accumulates in a person's body, according to National Organisation for Rare Disorders (NORD). At high levels, heavy metals can replace certain minerals in a variety of processes in the body, which can have deleterious effects. The symptoms of heavy-metal poisoning can vary, depending on the metals involved, according to NORD. Both arsenic and lead poisoning cause a wide range of symptoms, and can be life-threatening. Arsenic poisoning, for example, can cause symptoms such as headaches, drowsiness, confusion and seizures, as well as intestinal problems. Lead poisoning in adults can cause symptoms such as high blood pressure, muscle weakness and nerve pain.

Live Science, 3 December 2018

<http://www.livescience.com>

## 8 'Facts' About The Human Body Debunked by Science

2018-12-18

When you know a particular topic really well, you might say you know it like the back of your hand. But how well do you really know that hand? Or the rest of your body, for that matter? People have a tendency to share misinformation that, over time, can be misconstrued as fact. The human body is no exception. If you believe that alcohol warms the body (it can't), or that newborns can't feel pain (they can), that's the result of those urban legends and old wives' tales that have been repeated so often that we don't think to doubt their veracity. Today, however, false facts about health and the human body spread at the speed of the internet, and the consequences can be disastrous. Something that seems as innocent as posting an article on social media can have major consequences, and we owe it to the rest of society to help the truth drown out the fiction. Thankfully, scientific research enables us to fact check those claims. When it comes to health and the human body, sometimes, getting it right can even save lives. Here are eight inaccurate claims about the human body, debunked by real science.

### Myth 1: Your fingerprints are completely unique

For more than a century, fingerprints have played a major role in forensic investigations. It all started with Scottish scientist and physician Henry Faulds who, in 1888, wrote an article asserting that each person has a wholly unique set of fingerprints. Now, a single print in the wrong place can be enough for a criminal conviction. However, we have no way to

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conclusively prove that each of our collections of whorls, loops, and arches is unique (short of gathering the prints of every person who ever lived and comparing them). "It's impossible to prove that no two are the same," Mike Silverman, a forensic science regulator in the United Kingdom, told The Telegraph. "It's improbable, but so is winning the lottery, and people do that every week." There can be serious consequences if most people believe that fingerprint analysis is infallible. In 2005, Simon Cole, a criminologist at the University of California at Irvine, published a study detailing the 22 known cases of fingerprint mistakes in the history of the American legal system. He stressed the need to address this misconception lest more innocent people find themselves accused, or even convicted, of crimes they did not commit.

#### Myth 2: Rolling your tongue is a genetic trait

In 1940, geneticist Alfred Sturtevant published a paper claiming that genetics determined your ability to roll your tongue - parents who could roll their tongues were likely to have children who could as well. Just 12 years later, geneticist Philip Matlock disproved this finding with a study of his own. When he compared 33 sets of identical twins, he found that seven of those pairs contained one twin that could roll his or her tongue but the other couldn't. Since the genes of identical twins are the same, genes clearly weren't the deciding factor for tongue rolling. Still, the misconception persists 65 years after Matlock published his debunking study. And though it's not life-threatening, that misunderstanding can cause unnecessary stress. As evolutionary biologist John McDonald told PBS, he's received emails from children concerned that they aren't related to their parents because they don't share the ability.

#### Myth 3: You have five senses

Children often learn that they have five senses - sight, hearing, taste, touch, and smell. That's a "fact" that originated in a work by the Greek philosopher Aristotle, written around 350 B.C. However, you actually have more than five senses. Way more. In fact, scientists aren't even sure just how many more - estimates range from 22 to 33. Some of those other senses include equilibrioception (sense of balance), thermoception (sense of temperature), nociception (sense of pain), and kinaesthesia (sense of movement). While none of these additional senses include the ability to communicate with the dead, some are absolutely essential for life. For example, our sense of thirst helps our bodies maintain appropriate hydration levels, and people who lack that sense - a rare condition called adipsia - can become severely dehydrated or even die.

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#### Myth 4: Fingernails and hair continue to grow after death

Our bodies do lots of creepy things after we die, but they don't keep growing our fingernails and hair. To do that, our bodies need to produce new cells - something that simply isn't possible after death. This morbid misconception dates back until at least 1929 when writer Erich Remarque immortalised it in his novel *All Quiet on the Western Front*. In fact, his misunderstanding is due to an optical illusion. While our nails and hair don't continue to grow after we breathe our final breath, our skin does "shrink" as it becomes dehydrated. As the skin retracts, our nails and hair become more exposed, and, thus, they may appear to grow. Luckily, getting this one wrong isn't likely to cause much harm - beyond its potential to give children nightmares or exacerbate a person's thanatophobia, of course.

#### Myth 5: You should never wake a sleepwalker

Though about 7 percent of the population will sleepwalk at some point in their lives, no one knows for sure what causes somnambulism. What to do should you encounter a slumbering pedestrian is also a source of confusion thanks to a very old misconception. Mark Pressman, a psychologist and sleep specialist at Lankenau Hospital in Pennsylvania, told *Live Science* the belief that it's dangerous to wake a sleepwalker began in ancient times when people used to think your soul left your body while you slept. Waking a sleepwalker, therefore, would doom the sleeper to a soulless existence. The supposed consequences of waking a sleepwalker have since evolved - some say you could induce a heart attack, or send the sleeper into a permanent state of insanity. While Pressman said waking a sleepwalker won't harm them, it might not be easy to do. Letting a sleepwalker's journey continue uninterrupted is clearly not an option since it could have devastating consequences - sleepwalkers have been known to injure themselves or even die in their zombie-like state. The best course of action, therefore, is to simply guide a sleepwalker back to bed.

#### Myth 6: Swallowed chewing gum takes seven years to digest

If you believe the legend, gum you swallowed years ago is still in your body; your digestive tract is still working on the chewy mass. While it's impossible to pinpoint the origin of that myth, debunking it is fairly easy. Gum is chewy because it contains a synthetic rubber base that simply isn't digestible. But that doesn't mean swallowed gum can't complete the journey through your digestive tract. As Rodger Liddle, a gastroenterologist at the Duke University School of Medicine, told *Scientific American*, the human body is capable of passing objects up

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to roughly the size of a quarter, so a single piece of gum should pose no problem. If you were to swallow several pieces of chewing gum in a short amount of time, though, you could end up with a mass too large to pass. At that point, you may need to call on a doctor to remove it manually - in 1998, paediatric gastroenterologist David Milov published a study noting three such cases in children, and the ordeal does not seem pleasant.

#### Myth 7: Most of your body heat escapes through your head

This misconception isn't nearly as old as some of the others, and it is believed to have (somewhat) scientific origins. Health services researchers Rachel Vreeman and Aaron Carroll told *The Guardian* this myth most likely took root in the 1950s when the U.S. military conducted a study to determine how cold weather would affect soldiers. As legend has it, they dressed volunteers in arctic survival suits and observed how their bodies reacted to freezing-cold temperatures. The military concluded that the volunteers lost most of their heat from their heads, seeming to ignore the fact that the head was the only body part that wasn't protected from the elements. Two decades later, a US Army survival manual incorporated those findings, stressing the importance of covering the head when exposed to cold conditions to avoid losing "40 to 45 percent of body heat." A myth was born. As Vreeman and Carroll told *The Guardian*, no one body part has a greater impact than any other when it comes to retaining heat. A 2008 study by University of British Columbia School of Kinesiology researcher Thea Pretorius supports that estimate. In that study, eight subjects spent 45 minutes in water kept a chilly 17 degrees Celsius (62 degrees Fahrenheit). Some participants had their heads submerged, while some were in only up to their necks. Those with their heads submerged lost 11 percent more heat. Because the head accounts for about 7 percent of the body's surface area, it doesn't seem much more important than any other part of the body for retaining heat.

#### Myth 8: Some people are double-jointed

Chances are you've watched someone pull her thumb back to meet her forearm or bend his leg forward at the knee. Maybe you can do these things yourself. Either way, you know most people can't, which perpetuates the myth that people can be double-jointed. Ultimately, this misconception comes down to a matter of language. No one is born with extra joints, but some are born with joints that are extra flexible. This condition is called hypermobility or joint laxity, and it affects an estimated 10 to 25 percent of the population. Hypermobility is typically caused by

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either abnormally shaped bones or loose ligaments, USC anatomist and vertebrate paleontologist Michael Habib told the BBC.

Science Alert, 8 December 2018

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

### How catnip makes the chemical that causes cats to go crazy

2018-12-18

Researchers at John Innes Centre have shed light on how catnip—also known as catmint—produces the chemical that sends cats into a state of wanton abandon. The remarkable effect catnip has on cats is well known thanks to the scores on online videos showing pets enjoying its intoxicating highs. The substance that triggers this state of feline ecstasy is called nepetalactone, a type of chemical called a terpene. This simple, small molecule is part of an unusual chain of events, not previously seen by chemists. The researchers believe that understanding the production of these nepetalactones could help them recreate the way that plants synthesise other chemicals like vinblastine, which is used for chemotherapy. This could lead to the ability to create these useful medicines more efficiently and quickly than we are currently able to harvest them from nature. Usually in plants, for example peppermint, terpenes are formed by a single enzyme. In their paper published online this week in *Nature Chemical Biology*, the researchers report that in catnip terpenes are formed in a two-step process; an enzyme activates a precursor compound which is then grabbed by a second enzyme to produce the substance of interest. This two-step process has previously never been observed, and the researchers also expect something similar is occurring in the synthesis of anti-cancer drugs vincristine and vinblastine from Madagascan periwinkle, *Catharanthus roseus*, and elsewhere in olive and snapdragon. In the publication, the team describe the process by which catmint produces nepetalactone in microscopic glands on the underside of its leaves. The study also identifies three new enzymes with unusual activity. Dr. Benjamin Lichman, who conducted the work while a post-doc at John Innes Centre and who is now a lecturer at the University of York, says: "We have made significant progress in understanding how catnip makes nepetalactones, the chemicals that sends cats crazy. Catnip is performing unusual and unique chemical processes, and we plan to use these to help us create useful compounds that can be used in treatment of diseases such as cancer. We are also working to understand the evolution of catnip to understand how it came to produce the cat-active chemicals."

**Catnip has a well-known effect on cats, its intoxicating highs are caused by nepetalactone, a type of chemical called a terpene.**

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Professor Sarah O'Connor, project leader at the John Innes Centre, says: "Nepetalactones have potential use in agriculture as they participate in certain plant-insect interactions. In future work we will explore the roles that these compounds have in plants."

Phys. Org, 10 December 2018

<http://phys.org>

### Invisible pollutants and the tipping point for endocrine disruption

2018-12-18

This is the story of how the introduction and inundation of hundreds if not thousands of chemicals have literally changed—and by that, I mean damaged—the bodies and brains of millions of people. It's the story of how many of the diseases may not yet visibly affect adults but will impact their offspring a generation or more in the future. It's a story that shows how the surface of the communities we call home—regardless of whether these communities are urban, suburban, or rural—hides a pernicious threat to the health and futures of our children and grandchildren. Is all this simply the result of First World living? Yes and no. Many of these diseases have been attributed to sedentary lifestyles; processed, sugar-laden hyperpalatable foods; lack of exercise; and lack of access to fresh fruits and vegetables. Sequencing the human genome has made it possible to identify some of the origins of chronic diseases such as diabetes and obesity; brain disorders such as ADHD and autism; and reproductive conditions including endometriosis, low sperm count, and both male and female infertility. However, the closer we look, the more complicated the picture appears. Studies have shown that environmental exposures can modify the expression of genes (without changing the coding sequence), leading to diseases and dysfunctions. This suggests that there are other factors, so far hidden, triggering such a profound increase in these so-called lifestyle disorders. What we now know, through rich and varied research from all over the world, is that among the hidden factors are environmental exposures to chemicals that have leached into our soil, farms, and food supply; cosmetics, hygiene products, and household furniture; and our outdoor spaces such as gardens, lawns, fields, and recreational parks. The evidence linking cause and effect is strongest for four major categories of chemicals, but we know of at least a thousand more chemicals that are endocrine disruptors. And this is an underestimate; many chemicals have not been tested and so fly under the radar of both scientists and the medical community. The chemicals with

**How the introduction and inundation of hundreds if not thousands of chemicals have literally changed—and damaged—the bodies and brains of**

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the strongest evidence of health effects are pesticides, flame retardants, plasticiser chemicals, and bisphenols, which are used to line food and beverage cans. At first it was thought that these chemicals had to persist in the body to cause harm, like a viral or bacterial infection. Now we realise that though the chemicals themselves are often excreted within a few days, they leave lasting effects. And here is the scariest piece: the effects of this chemical contact can reverberate years later and even be passed on to the next generation. This is what I call the “hit-and-run” impact of these pernicious chemicals. They have been shown to have potent, long-lasting, life-altering effects on all of us, but especially babies and young children, whose organs are just developing, including:

- lower IQs,
- obesity,
- type 2 diabetes,
- birth defects,
- infertility,
- endometriosis,
- attention-deficit/hyperactivity disorder,
- fibroids,
- low sperm count,
- testicular cancer,
- heart disease,
- autism, and
- breast cancer.

You may wonder how such a diverse group of conditions can have something in common. They do—and it’s a marker of endocrine disruption directly linked to any one or a mix of thousands of chemicals that are not yet regulated by the United States and that continue to be produced and used commercially in hundreds of products. Although we have not yet studied all of the chemicals that exist in our homes, food supply, and environment, research supports strong if not certain links between these four groups of chemicals and diseases in at least three systems that are essential for good health: the brain and nervous system, metabolism, and reproductive functioning. Though earlier scientific publications and books had raised the alarm of endocrine disruption, a 2009 scientific statement by the Endocrine Society formally put this issue on the medical and scientific map. The 17,000 members of the Endocrine Society are scientists and doctors practicing endocrinology from 120 countries, making it “the

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world's oldest, largest, and most active organization devoted to research on hormones and the clinical practice of endocrinology." In 2012, the World Health Organization and United Nations Environment Program published a report documenting endocrine-disrupting chemicals as a "major and emerging global public health threat." Three years later, the International Federation of Gynaecology and Obstetrics published its own recommendations, calling for timely action to prevent harm. Later in 2015, a second statement by the Endocrine Society documented even greater scientific evidence—1,331 scientific references—and concern for endocrine-disrupting chemicals and their effect on human health. Most recently, in July 2018, the American Academy of Paediatrics raised the alarm about synthetic chemicals intentionally added to or inadvertently contaminating foods, urging families and policymakers to act. These major international organisations are making it loud and clear: the evidence continues to grow and grow; now is the time to take concrete steps.

Environmental Health News, 14 December 2018

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

### **Johnson & Johnson knew for decades that asbestos lurked in its Baby Powder**

2018-12-18

Darlene Coker knew she was dying. She just wanted to know why. She knew that her cancer, mesothelioma, arose in the delicate membrane surrounding her lungs and other organs. She knew it was as rare as it was deadly, a signature of exposure to asbestos. And she knew it afflicted mostly men who inhaled asbestos dust in mines and industries such as shipbuilding that used the carcinogen before its risks were understood. Coker, 52 years old, had raised two daughters and was running a massage school in Lumberton, a small town in eastern Texas. How had she been exposed to asbestos? "She wanted answers," her daughter Cady Evans said. Fighting for every breath and in crippling pain, Coker hired Herschel Hobson, a personal-injury lawyer. He homed in on a suspect: the Johnson's Baby Powder that Coker had used on her infant children and sprinkled on herself all her life. Hobson knew that talc and asbestos often occurred together in the earth, and that mined talc could be contaminated with the carcinogen. Coker sued Johnson & Johnson, alleging that "poisonous talc" in the company's beloved product was her killer. J&J denied the claim. Baby Powder was asbestos-free, it said. As the case proceeded, J&J was able to avoid handing over talc test results and other internal company records Hobson had requested to make the case against Baby Powder.

**J&J didn't tell the FDA that at least three tests by three different labs from 1972 to 1975 had found asbestos in its talc – in one case at levels reported as "rather high."**

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Coker had no choice but to drop her lawsuit, Hobson said. "When you are the plaintiff, you have the burden of proof," he said. "We didn't have it." That was in 1999. Two decades later, the material Coker and her lawyer sought is emerging as J&J has been compelled to share thousands of pages of company memos, internal reports and other confidential documents with lawyers for some of the 11,700 plaintiffs now claiming that the company's talc caused their cancers — including thousands of women with ovarian cancer.

A Reuters examination of many of those documents, as well as deposition and trial testimony, shows that from at least 1971 to the early 2000s, the company's raw talc and finished powders sometimes tested positive for small amounts of asbestos, and that company executives, mine managers, scientists, doctors and lawyers fretted over the problem and how to address it while failing to disclose it to regulators or the public. The documents also depict successful efforts to influence U.S. regulators' plans to limit asbestos in cosmetic talc products and scientific research on the health effects of talc. A small portion of the documents have been produced at trial and cited in media reports. Many were shielded from public view by court orders that allowed J&J to turn over thousands of documents it designated as confidential. Much of their contents is reported here for the first time. The earliest mentions of tainted J&J talc that Reuters found come from 1957 and 1958 reports by a consulting lab. They describe contaminants in talc from J&J's Italian supplier as fibrous and "acicular," or needle-like, tremolite. That's one of the six minerals that in their naturally occurring fibrous form are classified as asbestos. At various times from then into the early 2000s, reports by scientists at J&J, outside labs and J&J's supplier yielded similar findings. The reports identify contaminants in talc and finished powder products as asbestos or describe them in terms typically applied to asbestos, such as "fibreform" and "rods." In 1976, as the U.S. Food and Drug Administration (FDA) was weighing limits on asbestos in cosmetic talc products, J&J assured the regulator that no asbestos was "detected in any sample" of talc produced between December 1972 and October 1973. It didn't tell the agency that at least three tests by three different labs from 1972 to 1975 had found asbestos in its talc — in one case at levels reported as "rather high." Most internal J&J asbestos test reports Reuters reviewed do not find asbestos. However, while J&J's testing methods improved over time, they have always had limitations that allow trace contaminants to go undetected — and only a tiny fraction of the company's talc is tested. The World Health Organization and other authorities recognise no safe level of exposure to asbestos. While most people exposed never develop cancer, for some,

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even small amounts of asbestos are enough to trigger the disease years later. Just how small hasn't been established. Many plaintiffs allege that the amounts they inhaled when they dusted themselves with tainted talcum powder were enough. The evidence of what J&J knew has surfaced after people who suspected that talc caused their cancers hired lawyers experienced in the decades-long deluge of litigation involving workers exposed to asbestos. Some of the lawyers knew from those earlier cases that talc producers tested for asbestos, and they began demanding J&J's testing documentation. In two cases earlier, this year – in New Jersey and California – juries awarded big sums to plaintiffs who, like Coker, blamed asbestos-tainted J&J talc products for their mesothelioma.

A third verdict, in St. Louis, was a watershed, broadening J&J's potential liability: The 22 plaintiffs were the first to succeed with a claim that asbestos-tainted Baby Powder and Shower to Shower talc, a long-time brand the company sold in 2012, caused ovarian cancer, which is much more common than mesothelioma. The jury awarded them \$4.69 billion in damages. Most of the talc cases have been brought by women with ovarian cancer who say they regularly used J&J talc products as a perineal antiperspirant and deodorant. At the same time, at least three juries have rejected claims that Baby Powder was tainted with asbestos or caused plaintiffs' mesothelioma. Others have failed to reach verdicts, resulting in mistrials. J&J has said it will appeal the recent verdicts against it. It has maintained in public statements that its talc is safe, as shown for years by the best tests available, and that the information it has been required to divulge in recent litigation shows the care the company takes to ensure its products are asbestos-free. It has blamed its losses on juror confusion, "junk" science, unfair court rules and overzealous lawyers looking for a fresh pool of asbestos plaintiffs. "Plaintiffs' attorneys out for personal financial gain are distorting historical documents and intentionally creating confusion in the courtroom and in the media," Ernie Knewitz, J&J's vice president of global media relations, wrote in an emailed response to Reuters' findings. "This is all a calculated attempt to distract from the fact that thousands of independent tests prove our talc does not contain asbestos or cause cancer. Any suggestion that Johnson & Johnson knew or hid information about the safety of talc is false." J&J declined to comment further for this article. For more than two months, it turned down repeated requests for an interview with J&J executives. On 8 December, the company offered to make an expert available. It had not done so. The company referred all inquiries to its outside litigation counsel, Peter Bicks. In emailed responses, Bicks rejected Reuters' findings as "false and misleading." "The scientific consensus is that the talc used in talc-based

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body powders does not cause cancer, regardless of what is in that talc," Bicks wrote. "This is true even if - and it does not - Johnson & Johnson's cosmetic talc had ever contained minute, undetectable amounts of asbestos." He dismissed tests cited in this article as "outlier" results. In court, J&J lawyers have told jurors that company records showing that asbestos was detected in its talc referred to talc intended for industrial use. Other records, they have argued, referred to non-asbestos forms of the same minerals that their experts say are harmless. J&J has also argued that some tests picked up "background" asbestos - stray fibres that could have contaminated samples after floating into a mill or lab from a vehicle clutch or fraying insulation. The company has made some of the same arguments about lab tests conducted by experts hired by plaintiffs. One of those labs found asbestos in Shower to Shower talc from the 1990s, according to an Aug. 11, 2017, court report. Another lab found asbestos in more than half of multiple samples of Baby Powder from past decades - in bottles from plaintiffs' cupboards and acquired from eBay, and even a 1978 bottle held in J&J's corporate museum. The concentrations were great enough that users "would have, more likely than not, been exposed," the plaintiffs' lab report presented in several cases this year concluded. Matthew Sanchez, a geologist with consultants, RJ Lee Group Inc, and a frequent expert witness for J&J, dismissed those findings in testimony in the St. Louis trial: "I have not found asbestos in any of the current or modern, what I consider modern, Johnson & Johnson talc products," Sanchez told the jury. Sanchez did not return calls seeking comment. RJ Lee said it does not comment on the work it does for clients.

Since 2003, talc in Baby Powder sold in the United States has come from China through supplier Imerys Talc America, a unit of Paris-based Imerys SA and a co-defendant in most of the talc litigation. Imerys and J&J said the Chinese talc is safe. An Imerys spokesman said the company's tests "consistently show no asbestos. Talc's safe use has been confirmed by multiple regulatory and scientific bodies."

J&J, based in New Brunswick, New Jersey, has dominated the talc powder market for more than 100 years, its sales outpacing those of all competitors combined, according to Euromonitor International data. And while talc products contributed just \$420 million to J&J's \$76.5 billion in revenue last year, Baby Powder is considered an essential facet of the healthcare-products maker's carefully tended image as a caring company - a "sacred cow," as one 2003 internal email put it. "When people really understand what's going on, I think it increases J&J's exposure a thousand-fold," said Mark Lanier, one of the lawyers for the women in

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the St. Louis case. The mounting controversy surrounding J&J talc hasn't shaken investors. The share price is up about 6 percent so far this year. Talc cases make up fewer than 10 percent of all personal injury lawsuits pending against J&J, based on the company's Aug. 2 quarterly report, in which the company said it believed it had "strong grounds on appeal." J&J Chairman and Chief Executive Officer Alex Gorsky has pledged to fight on, telling analysts in July: "We remain confident that our products do not contain asbestos." Gorsky's comment, echoed in countless J&J statements, misses a crucial point. Asbestos, like many environmental carcinogens, has a long latency period. Diagnosis usually comes years after initial exposure – 20 years or longer for mesothelioma. J&J talc products today may be safe, but the talc at issue in thousands of lawsuits was sold and used over the past 60 years. That point is recognised in a 2013 markup of a statement for the "Safety & Care Commitment" page of J&J's website. The original version conveyed a blanket assurance of safety. The edited version was less definitive: "Our talc-based consumer products have always been (we cannot say "always") asbestos free, as confirmed by regular testing since the 1970s." In 1886, Robert Wood Johnson enlisted his younger brothers in an eponymous start-up built around the "Safety First" motto. Johnson's Baby Powder grew out of a line of medicated plasters, sticky rubber strips loaded with mustard and other home remedies. When customers complained of skin irritation, the brothers sent packets of talc. Soon, mothers began applying the talc to infants' diaper-chafed skin. The Johnsons took note. They added a fragrance that would become one of the most recognisable in the world, sifted the talc into tin boxes and, in 1893, began selling it as Johnson's Baby Powder. In the late 1950s, J&J discovered that talc from its chief source mine for the U.S. market in the Italian Alps contained tremolite. That's one of six minerals – along with chrysotile, actinolite, amosite, anthophyllite and crocidolite – that occur in nature as crystalline fibres known as asbestos, a recognised carcinogen. Some of them, including tremolite, also occur as unremarkable "non-asbestiform" rocks. Both forms often occur together and in talc deposits.

J&J's worry at the time was that contaminants made the company's powder abrasive. It sent tons of its Italian talc to a private lab in Columbus, Ohio, to find ways to improve the appearance, feel and purity of the powder by removing as much "grit" as possible. In a pair of reports from 1957 and 1958, the lab said the talc contained "from less than 1 percent to about 3 percent of contaminants," described as mostly fibrous and "acicular" tremolite. Most of the authors of these and other J&J records cited in this article are dead. Sanchez, the RJ Lee geologist whose firm has agreed to provide him as a witness in up to 100 J&J talc trials, has testified

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that tremolite found decades ago in the company's talc, from Italy and later Vermont, was not tremolite asbestos at all. Rather, he has said, it was "cleavage fragments" from non-asbestiform tremolite. J&J's original records don't always make that distinction. In terms of health risk, regulators since the early 1970s have treated small fibre-shaped particles of both forms the same. The U.S. Environmental Protection Agency, for example, "makes no distinction between fibres and (comparable) cleavage fragments," agency officials wrote in a response to an RJ Lee report on an unrelated matter in 2006, the year before the firm hired Sanchez. The Occupational Safety and Health Administration (OSHA), though it dropped the non-fibrous forms of the minerals from its definition of asbestos in 1992, nonetheless recommends that fibre-shaped fragments indistinguishable from asbestos be counted in its exposure tests. And as the product safety director for J&J's talc supplier acknowledged in a 2008 email to colleagues: "(I)f a deposit contains 'non-asbestiform' tremolite, there is also asbestiform tremolite naturally present as well." In 1964, J&J's Windsor Minerals Inc subsidiary bought a cluster of talc mines in Vermont, with names like Argonaut, Rainbow, Frostbite and Black Bear. By 1966, it was blasting and bulldozing white rock out of the Green Mountain state. J&J used the milled powder in its cosmetic powders and sold a less-refined grade to roofing, flooring and tire companies for use in manufacturing. Ten years after tremolite turned up in the Italian talc, it showed up in Vermont talc, too. In 1967, J&J found traces of tremolite and another mineral that can occur as asbestos, according to a table attached to a Nov. 1, 1967, memo by William Ashton, the executive in charge of J&J's talc supply for decades. J&J continued to search for sources of clean talc. But in an April 9, 1969, memo to a company doctor, Ashton said it was "normal" to find tremolite in many U.S. talc deposits. He suggested J&J rethink its approach. "Historically, in our Company, Tremolite has been bad," Ashton wrote. "How bad is Tremolite medically, and how much of it can safely be in a talc base we might develop?" Since pulmonary disease, including cancer, appeared to be on the rise, "it would seem to be prudent to limit any possible content of Tremolite ... to an absolute minimum," came the reply from another physician executive days later.

The doctor told Ashton that J&J was receiving safety questions from paediatricians. Even Robert Wood Johnson II, the founder's son and then-retired CEO, had expressed "concern over the possibility of the adverse effects on the lungs of babies or mothers," he wrote. "We have replied," the doctor wrote, that "we would not regard the usage of our powders as presenting any hazard." Such assurances would be impossible, he added, "if we do include Tremolite in more than unavoidable trace amounts." The

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memo is the earliest J&J document reviewed by Reuters that discusses tremolite as more than a scratchy nuisance. The doctor urged Ashton to consult with company lawyers because “it is not inconceivable that we could become involved in litigation.” By the early 1970s, asbestos was widely recognised as the primary cause of mesothelioma among workers involved in producing it and in industries that used it in their products. Regulation was in the air. In 1972, President Richard Nixon’s newly created OSHA issued its first rule, setting limits on workplace exposure to asbestos dust. By then, a team at Mount Sinai Medical Centre led by pre-eminent asbestos researcher Irving Selikoff had started looking at talcum powders as a possible solution to a puzzle: Why were tests of lung tissue taken post mortem from New Yorkers who never worked with asbestos finding signs of the mineral? Since talc deposits are often laced with asbestos, the scientists reasoned, perhaps talcum powders played a role. They shared their preliminary findings with New York City’s environmental protection chief, Jerome Kretchmer. On June 29, 1971, Kretchmer informed the Nixon administration and called a press conference to announce that two unidentified brands of cosmetic talc appeared to contain asbestos. The FDA opened an inquiry. J&J issued a statement: “Our fifty years of research knowledge in this area indicates that there is no asbestos contained in the powder manufactured by Johnson & Johnson.” Later that year, another Mount Sinai researcher, mineralogist Arthur Langer, told J&J in a letter that the team had found a “relatively small” amount of chrysotile asbestos in Baby Powder. Langer, Selikoff and Kretchmer ended up on a J&J list of “antagonistic personalities” in a Nov. 29, 1972, memo, which described Selikoff as the leader of an “attack on talc.” “I suppose I was antagonistic,” Langer told Reuters. Even so, in a subsequent test of J&J powders in 1976, he didn’t find asbestos – a result that Mount Sinai announced. Langer said he told J&J lawyers who visited him last year that he stood by all of his findings. J&J has not called him as a witness. Selikoff died in 1992. Kretchmer said he recently read that a jury had concluded that Baby Powder was contaminated with asbestos. “I said to myself, ‘How come it took so long?’” he said.

In July 1971, meanwhile, J&J sent a delegation of scientists to Washington to talk to the FDA officials looking into asbestos in talcum powders. According to an FDA account of the meeting, J&J shared “evidence that their talc contains less than 1%, if any, asbestos.” Later that month, Wilson Nashed, one of the J&J scientists who visited the FDA, said in a memo to the company’s public relations department that J&J’s talc contained trace amounts of “fibrous minerals (tremolite/actinolite).” As the FDA continued to investigate asbestos in talc, J&J sent powder samples to

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be tested at private and university labs. Though a private lab in Chicago found trace amounts of tremolite, it declared the amount “insignificant” and the samples “substantially free of asbestiform material.” J&J reported that finding to the FDA under a cover letter that said the “results clearly show” the samples tested “contain no chrysotile asbestos.” J&J’s lawyer told Reuters the tremolite found in the samples was not asbestos. But J&J’s FDA submission left out University of Minnesota professor Thomas E. Hutchinson’s finding of chrysotile in a Shower to Shower sample – “incontrovertible asbestos,” as he described it in a lab note. The FDA’s own examinations found no asbestos in J&J powder samples in the 1970s. Those tests, however, did not use the most sensitive detection methods. An early test, for example, was incapable of detecting chrysotile fibres, as an FDA official recognised in a J&J account of an 11 August 1972, meeting with the agency: “I understand that some samples will be passed even though they contain such fibres, but we are willing to live with it.” By 1973, Tom Shelley, director of J&J’s Central Research Laboratories in New Jersey, was looking into acquiring patents on a process that a British mineralogist and J&J consultant was developing to separate talc from tremolite. “It is quite possible that eventually tremolite will be prohibited in all talc,” Shelley wrote on Feb. 20, 1973, to a British colleague. Therefore, he added, the “process may well be valuable property to us.” At the end of March, Shelley recognised the sensitivity of the plan in a memo sent to a J&J lawyer in New Jersey: “We will want to carefully consider the ... patents re asbestos in talc. It’s quite possible that we may wish to keep the whole thing confidential rather than allow it to be published in patent form and thus let the whole world know.” J&J did not obtain the patents. While Shelley was looking into the patents, J&J research director DeWitt Petterson visited the company’s Vermont mining operation. “Occasionally, sub-trace quantities of tremolite or actinolite are identifiable,” he wrote in an April 1973 report on the visit. “And these might be classified as asbestos fibre.” J&J should “protect our powder franchise” by eliminating as many tiny fibres that can be inhaled in airborne talc dust as possible, Petterson wrote. He warned, however, that “no final product will ever be made which will be totally free from respirable particles.” Introducing a cornstarch version of Baby Powder, he noted, “is obviously another answer.” Cornstarch came up again in a 5 March 1974, report in which Ashton, the J&J talc supply chief, recommended that the company research that alternative “for defensive reasons” because “the thrust against talc has centred primarily on biological problems alleged to result from the inhalation of talc and related mineral particles.” A few months after Petterson’s recognition that talc purity was a pipe dream, the FDA proposed a rule that talc used in drugs contain no more than 0.1

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percent asbestos. While the agency's cosmetics division was considering similar action on talcum powders, it asked companies to suggest testing methods.

At the time, J&J's Baby Powder franchise was consuming 20,000 tons of Vermont talc a year. J&J pressed the FDA to approve an X-ray scanning technique that a company scientist said in an April 1973 memo allowed for "an automatic 1% tolerance for asbestos." That would mean talc with up to 10 times the FDA's proposed limit for asbestos in drugs could pass muster. The same scientist confided in a 23 October 1973, note to a colleague that, depending on what test the FDA adopted for detecting asbestos in cosmetic talc, "we may have problems." The best way to detect asbestos in talc was to concentrate the sample and then examine it through microscopes, the Colorado School of Mines Research Institute told J&J in a 27 December 1973, report. In a memo, a J&J lab supervisor said the concentration technique, which the company's own researchers had earlier used to identify a "tremolite-type" asbestos in Vermont talc, had one limitation: "It may be too sensitive." "No mother was going to powder her baby with 1% of a known carcinogen irregardless of the large safety factor." J&J also launched research to find out how much powder a baby was exposed to during a diapering and how much asbestos could be in that powder and remain within OSHA's new workplace exposure limits. Its researchers had strapped an air sampling device to a doll to take measurements while it was powdered, according to J&J memos and the minutes of a 19 February 1974, meeting of the Cosmetic Toiletry and Fragrance Association (CTFA), an industry group. "It was calculated that even if talc were pure asbestos the levels of exposure of a baby during a normal powdering are far below the accepted tolerance limits," the minutes state. In a 6 September 1974, letter, J&J told the FDA that since "a substantial safety factor can be expected" with talc that contains 1 percent asbestos, "methods capable of determining less than 1% asbestos in talc are not necessary to assure the safety of cosmetic talc." Not everyone at the FDA thought that basing a detection method on such a calculation was a good idea. One official called it "foolish," adding, according to a J&J account of a February 1975 meeting: "No mother was going to powder her baby with 1% of a known carcinogen irregardless of the large safety factor." Having failed to persuade the FDA that up to 1 percent asbestos contamination was tolerable, J&J began promoting self-policing as an alternative to regulation. The centrepiece of this approach was a 15 March 1976, package of letters from J&J and other manufacturers that the CTFA gave to the agency to show that they had succeeded at eliminating asbestos from cosmetic talc. "The attached letters demonstrate

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responsibility of industry in monitoring its talcs,” the cover letter said. “We are certain that the summary will give you assurance as to the freedom from contamination by asbestos for materials of cosmetic talc products.” In its letter, J&J said samples of talc produced between December 1972 and October 1973 were tested for asbestos, and none was detected “in any sample.” J&J didn’t tell the FDA about a 1974 test by a professor at Dartmouth College in New Hampshire that turned up asbestos in talc from J&J – “fibreform” actinolite, as he put it. Nor did the company tell the FDA about a 1975 report from its long-time lab that found particles identified as “asbestos fibres” in five of 17 samples of talc from the chief source mine for Baby Powder. “Some of them seem rather high,” the private lab wrote in its cover letter.

Bicks, the J&J lawyer, said the contract lab’s results were irrelevant because the talc was intended for industrial use. He said the company now believes that the actinolite the Dartmouth professor found “was not asbestiform,” based on its interpretation of a photo in the original lab report. Just two months after the Dartmouth professor reported his findings, Windsor Minerals Research and Development Manager Vernon Zeitz wrote that chrysotile, “fibrous anthophyllite” and other types of asbestos had been “found in association with the Hammondsville ore body” – the Vermont deposit that supplied Baby Powder talc for more than two decades. Zeitz’s May 1974 report on efforts to minimise asbestos in Vermont talc “strongly urged” the adoption of ways to protect “against what are currently considered to be materials presenting a severe health hazard and are potentially present in all talc ores in use at this time.” Bicks said that Zeitz was not reporting on actual test results. The following year, Zeitz reported that based on weekly tests of talc samples over six months, “it can be stated with a greater than 99.9% certainty that the ores and materials produced from the ores at all Windsor Mineral locations are free from asbestos or asbestiform minerals.” J&J’s selective use of test results figured in a New Jersey judge’s decision this year to affirm the first verdict against the company in a case claiming asbestos in J&J products caused cancer. “Providing the FDA favourable results showing no asbestos and withholding or failing to provide unfavourable results, which show asbestos, is a form of a misrepresentation by omission,” Middlesex County Superior Court Judge Ana Viscomi said in her June ruling. “J&J respectfully disagrees with the Judge’s comments,” Bicks said. “J&J did not withhold any relevant testing from FDA.” The FDA declined to comment on the ruling. Lacking consensus on testing methods, the FDA postponed action to limit asbestos in talc. Years later, it did set limits on asbestos in talc used in drugs. It has never limited asbestos in cosmetic

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talc or established a preferred method for detecting it. Instead, in 1976, a CTFA committee chaired by a J&J executive drafted voluntary guidelines, establishing a form of X-ray scanning with a 0.5 percent detection limit as the primary test, the method J&J preferred. The method is not designed to detect the most commonly used type of asbestos, chrysotile, at all. The group said the more sensitive electron microscopy was impractical. The CTFA, which now does business as the Personal Care Products Council, declined to comment. X-ray scanning is the primary method J&J has used for decades. The company also periodically requires the more sensitive checks with electron microscopes. J&J's lawyer said the company's tests exceed the trade association standard, and they do. He also said that today, J&J's X-ray scans can detect suspect minerals at levels as low as 0.1 percent of a sample. But the company never adopted the Colorado lab's 1973 recommendation that samples be concentrated before examination under a microscope. And the talc samples that were subjected to the most sensitive electron microscopy test were a tiny fraction of what was sold. For those and other reasons, J&J couldn't guarantee its Baby Powder was asbestos-free when plaintiffs used it, according to experts, including some who testified for plaintiffs.

As early as 1976, Ashton, J&J's long-time talc overseer, recognised as much in a memo to colleagues. He wrote that talc in general, if subjected to the most sensitive testing method, using concentrated samples, "will be hard pressed in supporting purity claims." He described this sort of testing as both "sophisticated" and "disturbing." By 1977, J&J appeared to have tamped down concerns about the safety of talc. An internal August report on J&J's "Defence of Talc Safety" campaign noted that independent authorities had deemed cosmetic talc products to be "free of hazard." It attributed "this growing opinion" to the dissemination to scientific and medical communities in the United States and Britain of "favourable data from the various J&J sponsored studies." In 1984, FDA cosmetics chief and former J&J employee Heinz Eiermann reiterated that view. He told the New York Times that the agency's investigation a decade earlier had prompted the industry to ensure that talc was asbestos-free. "So, in subsequent analyses," he told the paper, "we really could not identify asbestos or only on very rare occasions." Two years later, the FDA rejected a citizen request that cosmetic talc carry an asbestos warning label, saying that even if there were trace contamination, the use of talc powder during two years of normal diapering would not increase the risk of cancer. In 1980, J&J began offering a cornstarch version of Baby Powder – to expand its customer base to people who prefer cornstarch, the company says. The persistence of the industry's view that cosmetic talc is asbestos-free is why no studies

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have been conducted on the incidence of mesothelioma among users of the products. It's also partly why regulations that protect people in mines, mills, factories and schools from asbestos-laden talc don't apply to babies and others exposed to cosmetic talc – even though Baby Powder talc has at times come from the same mines as talc sold for industrial use. J&J says cosmetic talc is more thoroughly processed and thus purer than industrial talc. Until recently, the American Cancer Society (ACS) accepted the industry's position, saying on its website: "All talcum products used in homes have been asbestos-free since the 1970s." After receiving inquiries from Reuters, the ACS in early December revised its website to remove the assurance that cosmetic talcs are free of asbestos. Now, it says, quoting the industry's standards, that all cosmetic talc products in the United States "should be free from detectable amounts of asbestos." The revised ACS web page also notes that the World Health Organization's International Agency for Research on Cancer classifies talc that contains asbestos as "carcinogenic to humans." Despite the success of J&J's efforts to promote the safety of its talc, the company's test lab found asbestos fibres in samples taken from the Vermont operation in 1984, 1985 and 1986. Bicks said: "The samples that we know of during this time period that contained a fibre or two of asbestos were not cosmetic talc samples." Then, in 1992, three years after J&J sold its Vermont mines, the new owner, Cyprus Minerals, said in an internal report on "important environmental issues" in its talc reserves that there was "past tremolite" in the Hammondsville deposit. Hammondsville was the primary source of Baby Powder talc from 1966 until its shutdown in 1990. Bicks rejected the Cyprus report as hearsay, saying there is no original documentation to confirm it. Hammondsville mine records, according to a 1993 J&J memo, "were destroyed by the mine management staff just prior to the J&J divestiture." Bicks said the destroyed documents did not include talc testing records. In 2002 and 2003, Vermont mine operators found chrysotile asbestos fibres on several occasions in talc produced for Baby Powder sold in Canada. In each case, a single fibre was recorded – a finding deemed "BDL" – below detection limit. Bicks described the finding as "background asbestos" that did not come from any talc source. In 2009, the FDA, responding to growing public concern about talc, commissioned tests on 34 samples, including a bottle of J&J Baby Powder and samples of Imerys talc from China. No asbestos was detected. FDA Commissioner Scott Gottlieb said the agency continues to receive a lot of questions about talc cosmetics. "I recognise the concern," he told Reuters. He said the agency's policing of cosmetics in general – fewer than 30 people regulating a "vast" industry – was "a place where we think we can be doing more." Gottlieb said the FDA planned to host a public forum in early 2019 to "look at how we

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would develop standards for evaluating any potential risk." An agency spokeswoman said that would include examining "scientific test methods for assessment of asbestos."

Before law school, Herschel Hobson worked at a rubber plant. There, his job included ensuring that asbestos in talc the workers were exposed to didn't exceed OSHA limits. That's why he zeroed in on Johnson's Baby Powder after he took on Darlene Coker as a client in 1997. The lawsuit Coker and her husband, Roy, filed that year against J&J in Jefferson County District Court in Beaumont, Texas, is the earliest Reuters found alleging Baby Powder caused cancer. Hobson asked J&J for any research it had into the health of its mine workers; talc production records from the mid-1940s through the 1980s; depositions from managers of three labs that tested talc for J&J; and any documents related to testing for fibrous or asbestiform materials. J&J objected. Hobson's "fishing expedition" would not turn up any relevant evidence, it asserted in a 6 May 1998, motion. In fact, among the thousands of documents Hobson's request could have turned up was a letter J&J lawyers had received only weeks earlier from a Rutgers University geologist confirming that she had found asbestos in the company's Baby Powder, identified in her 1991 published study as tremolite "asbestos" needles. Hobson agreed to postpone his discovery demands until he got the pathology report on Coker's lung tissue. Before it came in, J&J asked the judge to dismiss the case, arguing that Coker had "no evidence" Baby Powder caused mesothelioma. Ten days later, the pathology report landed: Coker's lung tissue contained tens of thousands of "long fibres" of four different types of asbestos. The findings were "consistent with exposure to talc containing chrysotile and tremolite contamination," the report concluded. "The asbestos fibres found raise a new issue of fact," Hobson told the judge in a request for more time to file an opposition to J&J's dismissal motion. The judge gave him more time but turned down his request to resume discovery. Without evidence from J&J and no hope of ever getting any, Hobson advised Coker to drop the suit. Hobson is still practicing law in Nederland, Texas. When Reuters told him about the evidence that had emerged in recent litigation, he said: "They knew what the problems were, and they hid it." J&J's records would have made a "100% difference" in Coker's case. Had the information about asbestos in J&J's talc come out earlier, he said, "maybe there would have been 20 years less exposure" for other people. Bicks, the J&J lawyer, said Coker dropped her case because "the discovery established that J&J talc had nothing to do with Plaintiff's disease, and that asbestos exposure from a commercial or occupational setting was the likely cause." Coker never learned why she had mesothelioma. She did beat the odds, though. Most

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patients die within a year of diagnosis. Coker held on long enough to see her two grandchildren. She died in 2009, 12 years after her diagnosis, at age 63. Coker's daughter Crystal Deckard was 5 when her sister, Cady, was born in 1971. Deckard remembers seeing the white bottle of Johnson's Baby Powder on the changing table where her mother diapered her new sister. "When Mom was given this death sentence, she was the same age as I am right now," Deckard said. "I have it in the back of my mind all the time. Could it happen to us? Me? My sister?"

Johnson & Johnson developed a strategy in the 1970s to deal with a growing volume of research showing that talc miners had elevated rates of lung disease and cancer: Promote the positive, challenge the negative. That approach was summed up by a J&J applied research director in a "strictly confidential" 3 March 3, memo to managers of the baby products division, which used the talc in J&J's signature Baby Powder. "Our current posture with respect to the sponsorship of talc safety studies has been to initiate studies only as dictated by confrontation," the memo said. "This philosophy, so far, has allowed us to neutralise or hold in check data already generated by investigators who question the safety of talc." Also, the memo said, "we minimise the risk of possible self-generation of scientific data which may be politically or scientifically embarrassing." J&J's effort to protect its iconic Baby Powder franchise by shaping research was led by physician and scientist executives. An early 1970s study of 1,992 Italian talc miners shows how it worked: J&J commissioned and paid for the study, told the researchers the results it wanted, and hired a ghost-writer to redraft the article that presented the findings in a journal. The effort entailed other attempts to influence research, including a U.S. government study of the health of talc workers in Vermont. J&J's Windsor Minerals Inc subsidiary, one of several mine operators involved in the study, developed a relationship with the U.S. National Institute of Occupational Safety and Health researchers to "even influence the conclusions" through suggestions of "subjective interpretations," according to a 1973 Windsor Minerals memo. A 1979 article in the *Journal of Environmental Pathology and Toxicology* detailing the findings of the study was not good news for talc. It reported a "significant increase" in "respiratory cancer mortality" among miners. A subsequent analysis of the underlying data published in 1988 determined that at least one of the workers died of mesothelioma, the cancer most closely associated with asbestos. The proposal to study the health of miners of the Italian talc used in Baby Powder for decades came from William Ashton, J&J's long-time talc supply chief. Ashton had obtained a summary of miners' medical records compiled by an Italian physician, who also happened to control

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the country's talc exports. J&J should use those records "for maximum benefit," Ashton said in a May 8, 1973, letter to Dr Gavin Hildick-Smith, J&J's director of medical affairs. "It seems to me that the Italian records give us the opportunity to fortify a position on talc safety." At the time, the U.S. Food and Drug Administration was considering a limit on asbestos in talcs. In an 18 October 1973, memo, Hildick-Smith advised J&J: "The risk/benefit ratio of conducting an epidemiological study in these mines must be considered." By early 1974, the study was a go. Hildick-Smith sent money to the Italian talc exporter-physician to hire a team of researchers. Hildick-Smith told the lead researcher in a 26 June 1974, letter exactly what J&J wanted: data that "would show that the incidence of cancer in these subjects is no different from that of the Italian population or the rural control group." That is exactly what J&J got, Hildick-Smith told colleagues a few months later. At a meeting on 27 September 1974, for a "Talc/powder Safety Studies Review," he reported the Italian study would dispel the "cancer concern associated with exposure to talc." The following spring, Hildick-Smith got a draft of the Italian study from the lead researcher. It needed work to meet the "form and style" requirements of the target journal, he told colleagues in a 31 March 1975, memo. He added that he would send it to a scientific ghost-writer "who will hold it in confidence and rewrite it."

Reuters, 14 December 2018

<http://www.reuters.com>

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Neonicotinoid exposure disrupts bumblebee nest behaviour, social networks, and thermoregulation

Real-time combustion rate of wood charcoal in the heating fire basin: Direct measurement and its correlation to CO emissions

### MEDICAL RESEARCH

Investigation on drug-binding in heme pocket of CYP2C19 with UV-visible and resonance Raman spectroscopies

Integrative bioinformatics identifies postnatal lead (Pb) exposure disrupts developmental cortical plasticity

An ultrasensitive sensor based on quantitatively modified upconversion particles for trace bisphenol A detection

The Impact of Nutrition and Environmental Epigenetics on Human Health and Disease

Amyloid beta-positive subjects exhibit longitudinal network-specific reductions in spontaneous brain activity

### OCCUPATIONAL RESEARCH

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Potential Hazards Not Communicated in Safety Data Sheets of Flavouring Formulations, Including Diacetyl and 2,3-Pentanedione

Risk Perceptions and Barriers to Protective Behaviour Use Among Chemical Tank Cleaners: An Exploratory Study

Insecticide toxic effects and blood biochemical alterations in occupationally exposed individuals in Punjab, Pakistan

### **PUBLIC HEALTH RESEARCH**

Carcinogenic Potency of Airborne Polycyclic Aromatic Hydrocarbons in Relation to the Particle Fraction Size

A State-of-the-Science Review of Mercury Biomarkers in Human Populations Worldwide between 2000 and 2018

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Organophosphate flame-retardant metabolite concentrations and pregnancy loss among women conceiving with assisted reproductive technology

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