# Bulletin Board

AUG. 30, 2019

CHEMWATCH

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## CURIOSITIES



## TECHNICAL NOTES

# Regulatory Update



ASIA PACIFIC

## New guidance for labour hire available

*2019-08-22*

The new guide Labour hire: duties of persons conducting a business or undertaking, is now available on the Safe Work Australia website. Businesses using or providing labour hire should read the guide for information about their WHS responsibilities. The guide provides information for persons conducting a business or undertaking (PCBUs) in labour hire arrangements on complying with their health and safety duties under the model Work Health and Safety (WHS) laws. There are new practical examples and guidance on the duty of host and labour hire PCBUs to consult, cooperate and coordinate. Labour hire often involves a host organisation using workers from a labour hire agency, for a short period of time. These arrangements are sometimes referred to as "on-hire" or "agency" arrangements. A copy of the new guide is available at: **New guidance for labour hire available**

Safe Work Australia, 16 August 2019

http://www.safeworkaustralia.gov.au

**The new guide Labour hire: duties of persons conducting a business or undertaking, is now available on the Safe Work Australia website.**

## Variations to Schedule 20–Maximum residue limits

*2019-08-22*

On 13 August 2019, the Australian Pesticides and Veterinary Medicine Authority (APVMA) published variations to Schedule 20- Maximum residue limits in the APVMA Regulatory Update. The following tables highlight the variations made.

**[1] The table to section S20–3 in Schedule 20 is varied by [1.1] inserting in alphabetical order**

| ***Agvet chemical: Fluralaner*** | |
|---|---|
| *Permitted residue: Fluralaner* | |
| Cattle muscle | T*0.005 |
| Cattle liver | T*0.05 |
| Cattle kidney | T*0.025 |
| Cattle fat | T*0.06 |
| Sheep muscle | T*0.005 |
| Sheep liver | T*0.05 |

| *Agvet chemical: Fluralaner* | |
|---|---|
| Sheep kidney | T*0.025 |
| Sheep fat | T*0.06 |

| *Agvet chemical: Mefentrifluconazole* | |
|---|---|
| *Permitted residue: Mefentrifluconazole* | |
| Apple | 1 |
| Dried grapes (currants, raisins and sultanas) | 3 |
| Edible offal (mammalian) | 0.02 |
| Eggs | *0.01 |
| Grapes | 1 |
| Meat (mammalian) (in the fat) | 0.02 |
| Milks | *0.01 |
| Poultry, edible offal of | 0.02 |
| Poultry meat (in the fat) | *0.01 |

| *Agvet chemical: Topramezone* | |
|---|---|
| *Permitted residue: Topramezone* | |
| Barley | *0.01 |
| Edible offal (mammalian) | 0.05 |
| Eggs | *0.01 |
| Meat (mammalian) | *0.01 |
| Milks | *0.001 |
| Poultry, edible offal of | *0.01 |
| Poultry meat | *0.01 |
| Wheat | *0.01 |

**[1.2] omitting from each of the following chemicals, the foods and associated MRLs**

| *Agvet chemical: Cyprodinil* | |
|---|---|
| *Permitted residue: Cyprodinil* | |
| Bulb vegetables [except fennel, bulb; garlic; onion, bulb] | T3 |

| Agvet chemical: Fludioxonil | |
|---|---|
| *Permitted residue—commodities of animal origin: Sum of fludioxonil and oxidisable metabolites, expressed as fludioxonil*<br>*Permitted residue—commodities of plant origin: Fludioxonil* | |
| Bulb vegetables [except fennel, bulb; garlic; onion, bulb] | T3 |

| Agvet chemical: Glyphosate | |
|---|---|
| *Permitted residue: Sum of glyphosate, N-acetyl-glyphosate and aminomethylphosphonic acid (AMPA) metabolite, expressed as glyphosate* | |
| Oilseed [except cotton seed; peanut; linseed; poppy seed; rape seed (canola); sunflower seed] | T*0.1 |

| Agvet chemical: Phosphorous acid | |
|---|---|
| *Permitted residue: Phosphorous acid* | |
| Assorted tropical and sub-tropical fruits – inedible peel [except avocado] | T100 |

| Agvet chemical: Haloxyfop | |
|---|---|
| *Permitted residue: Sum of haloxyfop, its esters and conjugates, expressed as haloxyfop* | |
| Garlic | T0.05 |
| Guar bean (dry) | T2 |
| Sugar cane | T0.03 |

**[1.3] inserting for each of the following chemicals the foods and associated MRLs in alphabetical order**

| Agvet chemical: Acetamiprid | |
|---|---|
| *Permitted residue—commodities of plant origin: Acetamiprid*<br>*Permitted residue—commodities of animal origin: Sum of acetamiprid and N-demethyl acetamiprid ((E)-N1-[(6-chloro-3-pyridyl)methyl]-N2-cyanoacetamidine), expressed as acetamiprid* | |
| Avocado | 0.05 |
| Macadamia nuts | *0.01 |
| Mango | 0.05 |

# Regulatory Update



| ***Agvet chemical: Aminopyralid*** | |
|---|---|
| *Permitted residue—commodities of plant origin: Sum of aminopyralid and conjugates, expressed as aminopyralid*<br>*Permitted residue—commodities of animal origin: Aminopyralid* | |
| Rape seed (canola) | *0.01 |

| ***Agvet chemical: Bromoxynil*** | |
|---|---|
| *Permitted residue: Bromoxynil* | |
| Onion, bulb | T*0.01 |

| ***Agvet chemical: Cyprodinil*** | |
|---|---|
| *Permitted residue: Cyprodinil* | |
| Bulb vegetables [except fennel, bulb; onion, bulb] | T3 |

| ***Agvet chemical: Fludioxonil*** | |
|---|---|
| *Permitted residue—commodities of animal origin: Sum of fludioxonil and oxidisable metabolites, expressed as fludioxonil*<br>*Permitted residue—commodities of plant origin: Fludioxonil* | |
| Bulb vegetables [except fennel, bulb; onion, bulb] | T3 |

| ***Agvet chemical: Fluxapyroxad*** | |
|---|---|
| *Permitted residue: Fluxapyroxad* | |
| Tree nuts | 0.07 |

| ***Agvet chemical: Glyphosate*** | |
|---|---|
| *Permitted residue: Sum of glyphosate, N-acetyl-glyphosate and aminomethylphosphonic acid (AMPA) metabolite, expressed as glyphosate* | |
| Oilseed [except cotton seed; linseed; peanut; poppy seed; rape seed (canola); sesame seed; sunflower seed] | T*0. 1 |
| Sesame seed | T20 |

| ***Agvet chemical: Halauxifen-methyl*** | |
|---|---|
| *Permitted residue—commodities of plant origin: Halauxifen-methyl*<br>*Permitted residue—commodities of animal origin: 4-Amino-3-chloro-6-(4-chloro-2-fluoro-3-hydroxyphenyl)-pyridine-2-carboxylic acid, expressed as halauxifen-methyl* | |
| Rape seed | *0.01 |

# Regulatory Update



| ***Agvet chemical: Haloxyfop*** | |
|---|---|
| *Permitted residue: Sum of haloxyfop, its esters and conjugates, expressed as haloxyfop* | |
| Sesame seed | T0.1 |

| ***Agvet chemical: Imazapyr*** | |
|---|---|
| *Permitted residue: Imazapyr* | |
| Broad bean (dry) | T0.05 |

| ***Agvet chemical: Mandestrobin*** | |
|---|---|
| *Permitted residue: Mandestrobin* | |
| Beans, except broad bean and soya bean | 0.7 |
| Edible offal (Mammalian) | 0.02 |
| Lettuce, Head | 0.7 |
| Lettuce, Leaf | 7 |
| Meat (mammalian) (in the fat) | 0.02 |
| Milk | *0.02 |

| ***Agvet chemical: Metolachlor*** | |
|---|---|
| *Permitted residue: Metolachlor* | |
| Sesame seed | T*0.02 |

| ***Agvet chemical: Penthiopyrad***<br>*Permitted residue—commodities of plant origin: Penthiopyrad*<br>*Permitted residue—commodities of animal origin: Sum of penthiopyrad and 1-methyl-3-(trifluoromethyl)-1H-pyrazol-4-ylcarboxamide, expressed as penthiopyrad* | |
|---|---|
| Bayberries | T5 |
| Bayberry, red | T5 |

| ***Agvet chemical: Phosphorous acid*** | |
|---|---|
| *Permitted residue: Phosphorous acid* | |
| Assorted tropical and sub-tropical fruits – inedible peel [except avocado; passionfruit] | T100 |
| Passionfruit | T500 |

| Agvet chemical: Pirimicarb | |
|---|---|
| *Permitted residue: Sum of pirimicarb, demethyl-pirimicarb and the N-formyl-(methylamino) analogue (demethylformamido-pirimicarb), expressed as pirimicarb* | |
| Sesame seed | T0.05 |

| Agvet chemical: Pyripoxyfen | |
|---|---|
| *Permitted residue: Pyripoxyfen* | |
| Avocado | 0.05 |
| Macadamia nuts | *0.01 |

**[1.4] omitting for each of the following chemicals, the maximum residue limit for the food and substituting**

| Agvet chemical: Clofentezine | |
|---|---|
| *Permitted residue: Clofentezine* | |
| Tomato | T0.5 |

| Agvet chemical: Cyfluthrin | |
|---|---|
| *Permitted residue: Cyfluthrin, sum of isomers* | |
| Chia | T*0.05 |

| Agvet chemical: Pyraclostrobin | |
|---|---|
| *Permitted residue—commodities of plant origin: Pyraclostrobin*<br>*Permitted residue—commodities of animal origin: Sum of pyraclostrobin and metabolites hydrolysed to 1-(4-chloro-phenyl)-1H-pyrazol-3-ol, expressed as pyraclostrobin* | |
| Tree nuts [except pistachio nut and walnut] | 0.07 |

APVMA Regulatory Update, 13 August 2019

http://www.apvma.gov.au

**The feedback received will help ensure any changes to Australia's classification and hazard communication requirements for workplace hazardous chemicals are implemented in the most effective way.**

## Updating the GHS under the model WHS laws – consultation summary

*2019-08-22*

An online consultation for the proposal to adopt an updated edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) under the model WHS laws was conducted in July 2019. Twenty-four submissions were received from a range of stakeholders, including

users of hazardous chemicals, manufacturers, suppliers, peak industry associations and government agencies. Safe Work Australia would like to thank everyone who provided feedback. The feedback received will help ensure any changes to Australia's classification and hazard communication requirements for workplace hazardous chemicals are implemented in the most effective way. For further information, the consultation summary is available on the Safe Work Australia website.

Safe Work Australia, 16 August 2019

http://www.safeworkaustralia.gov.au

## India Imposes Anti-dumping Duties on PTA Imported from South Korea and Thailand

*2019-08-22*

Recently, India's Ministry of Finance has imposed definitive anti-dumping duty on purified terephthalic acid (PTA) imported from South Korea and Thailand. The Revenue Department of India has now imposed a definitive anti-dumping duty of $27.32 per tonne on PTA produced by Hanwha General Chemical Co Ltd and exported by Hyosung TNC Corporation, based on the recommendations of the Designated Authority in the Commerce Ministry in its sunset review findings. For PTA exported by Taekwang Industrial Co Ltd, the Revenue Department has imposed definitive anti-dumping duty of $23.61 per tonne. For all other exporters from South Korea, it has been pegged at $78.28 per tonne. In the case of PTA exported by Indorama Petrochem Ltd and TPT Petrochemicals Public Co Ltd, Thailand, the Revenue Department has now imposed an anti-dumping duty of $45.43 per tonne. For all other exporters from Thailand, the duty has been pegged at $62.55 per tonne. The latest action comes in less than a month after the Designated Authority came up with its final findings on the sunset review. Further information is available at: Hindu Business Line

**Recently, India's Ministry of Finance has imposed definitive anti-dumping duty on purified terephthalic acid (PTA) imported from South Korea and Thailand.**

Chemlinked, 15 August 2019

http://chemlinked.com/en/news

## China Publishes Petrochemical Sector Carbon Emissions Norm

*2019-08-22*

On 30 July 2019, the Standardisation Administration of China (SAC) publicly announced the schedule for development of "*The Norm of Carbon*

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

Chemlinked, 6 August 2019

http://chemlinked.com/en/news

## AMERICA

### U.S. Department of Labor's OSHA Requests Information on Table 1 of the Silica Standard for Construction

*2019-08-22*

The United States Department of Labor's Occupational Safety and Health Administration (OSHA) is requesting information and comment on Table 1 of the agency's Respirable Crystalline Silica Standard for Construction. OSHA seeks information on additional engineering and work practice control methods to effectively limit exposure to silica for the equipment and tasks currently listed on Table 1. The agency is also requesting information about other construction equipment and tasks that generate silica that it should consider adding to Table 1, along with information about their associated engineering and work practice control methods. In addition, OSHA is seeking comments about whether to revise paragraph (a)(3) of the Respirable Crystalline Silica Standard for General Industry to broaden the circumstances under which general industry and maritime employers would be permitted to comply with Table 1 of the silica standard for construction. Information submitted will allow

**The United States Department of Labor's Occupational Safety and Health Administration (OSHA) is requesting information and comment on Table 1 of the agency's Respirable Crystalline Silica Standard for Construction.**

# Regulatory Update



OSHA to consider new developments and enhanced control methods for equipment that generates exposures to silica, and provide additional data on exposures to silica from equipment and tasks using a variety of control methods under different workplace conditions. Expanding Table 1 to include additional engineering and work practice control methods, equipment, and tasks could provide employers with more flexibility and reduce regulatory burdens while maintaining protections for employees. If information submitted in response to this request indicates that revisions to the silica standards are needed, the agency will then publish the proposed revisions in the Federal Register for public comment. Comments must be submitted by 14 October 2019. Comments and materials may be submitted electronically at http://www.regulations.gov, the Federal e-Rulemaking Portal. See the Federal Register notice for submission details.

U.S OSHA, 14 August 2019

http://www.osha.gov

## OEHHA Statement Regarding US EPA's Press Release and Registrant Letter on Glyphosate

*2019-08-22*

On 8 August 2019, the United States Environmental Protection Agency (US EPA) issued a press release and letter concerning cancer warnings for glyphosate that mischaracterised California's Proposition 65 right-to-know law. OEHHA added glyphosate to the Proposition 65 list of carcinogens in July 2017, based on a finding by the World Health Organization's International Agency for Research on Cancer (IARC) that glyphosate is both an animal carcinogen and "probably carcinogenic to humans". The listing was also supported by IARC's finding that studies of humans exposed to different glyphosate formulations in different geographic regions at different times reported similar increases in the same type of cancer - non-Hodgkin lymphoma. OEHHA's listing of glyphosate as a carcinogen was unanimously upheld by the California's Fifth District Court of Appeal following legal challenges by Monsanto Company and others who opposed the listing (see Monsanto v. Office of Environmental Health Hazard Assessment (2018) 22 Cal.App.5th 534). OEHHA objects to US EPA's characterisation of any warning concerning glyphosate's carcinogenicity as "a false claim". US EPA's assertion is based on its view that glyphosate is not likely to cause cancer in humans. That position conflicts with the determination made by IARC and its scientific panel, which included experts from the US National Cancer Institute, US EPA and the U.S.

**On 8 August 2019, the United States Environmental Protection Agency (US EPA) issued a press release and letter concerning cancer warnings for glyphosate that mischaracterised California's Proposition 65 right-to-know law.**

National Institute of Environmental Health, who carefully evaluated the extensive scientific evidence on glyphosate's carcinogenicity. It is disrespectful of the scientific process for US EPA to categorically dismiss any warnings based on IARC's determinations as false. Contrary to US EPA Administrator Andrew Wheeler's claim, California law does not "dictate federal policy." Proposition 65 does not require US EPA to take any action on glyphosate or any other listed chemical. Proposition 65 is a right-to-know statute approved overwhelmingly by California voters in 1986 that ensures consumers receive accurate, science-based information about the chemicals to which they are exposed. Through Proposition 65, California has reduced or eliminated exposures to toxic chemicals such as lead from faucets, children's jewellery, candy, artificial turf, tableware, and a host of other products. Further, warnings coupled with advice on how to reduce exposures, including information posted on OEHHA's warnings website (www.p65warnings.ca.gov), contribute to lower risks of chemical exposures and greater public health protections for Californians. Further information is available at: OEHHA Statement Regarding US EPA's Press Release and Registrant Letter on Glyphosate

OEHHA, 12 August 2019

http://www.oehha.ca.gov

## Trump administration reverses decision to use 'cyanide bombs' to kill wild animals

*2019-08-22*

**After sustained public outcry, the Trump administration has voided its decision to reauthorise controversial cyanide traps for killing wildlife.**

After sustained public outcry, the Trump administration has voided its decision to reauthorise controversial cyanide traps for killing wildlife. The traps, which are known as M-44s and dubbed "cyanide bombs" by critics, are spring-loaded devices that emit a spray of sodium cyanide to kill their targets. The traps are most frequently used by Wildlife Services, a little-known federal agency inside the United States Department of Agriculture, to kill coyotes, foxes and other animals at the behest of private agriculture operators. Last year, Wildlife Services killed more than 1.5 million native wild animals across the country, including bears, wolves, birds and more. Roughly 6,500 of these deaths were caused by M-44 traps. "I am announcing a withdrawal of EPA's interim registration review decision on sodium cyanide, the compound used in M-44 devices to control wild predators," Andrew Wheeler, the Environmental Protection Agency administrator, announced in a public statement. "This issue warrants further analysis and additional discussions by EPA with the registrants of this predacide." In an announcement last week, the EPA said

that it had authorised government officials to continue using M-44s on an interim basis. The decision sparked fury among wildlife advocates and others, who decried the decision as a reckless threat to humans and the environment. M-44s, which are deployed on public and private land across the US, have led in the past to the inadvertent deaths of endangered species and domestic pets. They have even harmed humans, including a teenage boy who was poisoned by an M-44 in Pocatello, Idaho, in 2017. Brooks Fahy, the executive director of Predator Defence, a wildlife group that is a leading opponent of M-44 traps, said the EPA's announcement was a welcome reversal. "Obviously somebody at EPA is paying attention to the public's concerns about cyanide bombs," Fahy said in a statement. "It would appear they're responding to public outrage over the interim decision from last week. Our phone has been ringing off the hook from concerned citizens regarding their greenlight to continue using these horrific devices. We'll have to see how this plays out."

The Guardian, 16 August 2019

http://www.guardian.com

## EPA Begins Public Comment Period for Manufacturer Requests for Risk Evaluations of DIDP and DINP

*2019-08-22*

On 16 August 2019. the United States Environmental Protection Agency (EPA) announced that it is opening a public comment period for manufacturer requests for the risk evaluations of diisodecyl phthalate (DIDP) and diisononyl phthalate (DINP), two chemicals used in plastic production. EPA notes that the manufacturer-requested risk evaluations "are among the first such evaluations of this kind to be requested" under the Toxic Substances Control Act (TSCA). EPA is also taking public comments on additional conditions of use it identified to include in the risk evaluations. Upon publication of the Federal Register notices, comments may be submitted to Docket ID EPA-HQ-OPPT-2018-0435 for DIDP and Docket ID EPA-HQ-OPPT-2018-0436 for DINP for 45 days. EPA encourages comments on any information not included in the manufacturer requests that commenters believe would be needed to conduct a risk evaluation. EPA also welcomes any other information relevant to the proposed determinations of the conditions of use, including information on other conditions of use of the chemicals than those included in the manufacturer requests or in EPA's proposed determinations. After the comment period closes, EPA will review the comments and within 60 days either grant or deny the requests to

**the United States Environmental Protection Agency (EPA) announced that it is opening a public comment period for manufacturer requests for the risk evaluations of diisodecyl phthalate (DIDP) and diisononyl phthalate (DINP), two chemicals used in plastic production.**

conduct risk evaluations. If these requests are granted, the manufacturers would be responsible for half the cost of the risk evaluations.

National Law Review, 18 August 2019

http://www.natlawreview.com

## California DPR Issues Cancellation Notices for Chlorpyrifos, and Establishes a Work Group to Recommend and to Develop Alternatives to Chlorpyrifos

*2019-08-22*

On 14 August 2019, the California Department of Pesticide Regulation (DPR) issued cancellation notices to thirteen California registrants of pesticide products containing chlorpyrifos, including Dow Agrosciences LLC (now Corteva). Each of these notices is referred to as an "Accusation," and each affected registrant has 15 days to request a hearing concerning the proposed cancellation. DPR's issuance of these notices followed a final decision by the U.S. Environmental Protection Agency (EPA) to deny an administrative petition to revoke the tolerances and cancel the U.S. registrations for chlorpyrifos. DPR states: "Despite the Trump administration's reversal of a decision to ban the pesticide at the federal level, California continues to move forward to protect public health, workers, and the environment." Although it is unusual for a State to act unilaterally to cancel a State registration for a pesticide that is still registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), FIFRA Section 24(a) provides that States may separately regulate Federally registered pesticides so long as they do not purport to authorize any sale or use that is otherwise prohibited under FIFRA. The risk assessment that supports DPR's proposal to cancel chlorpyrifos products is based on five animal studies published in 2016, 2017, and 2018, that report neurotoxicity from chlorpyrifos at exposure levels that are considerably lower than the levels that cause acetylcholinesterase inhibition. Based on its evaluation these studies, DPR has concluded that developmental neurotoxicity is the critical endpoint for chlorpyrifos and has derived a point of departure for chlorpyrifos risk assessment. Based on this assessment, DPR previously concluded that chlorpyrifos should be designated as a Toxic Air Contaminant (TAC). DPR presented its TAC findings to California's Scientific Review Panel at a meeting on 30 July 2018, and the Panel subsequently concluded that the DPR assessment of the developmental neurotoxicity of chlorpyrifos was "based on sound

**On 14 August 2019, the California Department of Pesticide Regulation (DPR) issued cancellation notices to thirteen California registrants of pesticide products containing chlorpyrifos, including Dow Agrosciences LLC (now Corteva).**

scientific knowledge, and represents a balanced assessment of our current scientific understanding." On the same day DPR issued its cancellation notices for chlorpyrifos, DPR also announced it has established an Alternatives to Chlorpyrifos Work Group with experts from "agriculture, California universities, environmental justice groups, farmworker health and safety organisations, and pesticide manufacturers…" DPR has asked this Work Group to develop short-term practical alternatives to chlorpyrifos, along with a five-year action plan. The Work Group is supposed to conclude its work by the spring of 2020. The budget for 2019-2020 approved by the California Legislature also includes $5 million in grant funding to develop sustainable alternatives to chlorpyrifos.

Commentary

The DPR decision to cancel chlorpyrifos relies primarily on new animal studies that report that chlorpyrifos causes neurodevelopmental effects at levels that are well below those that inhibit cholinesterase. DPR refers in passing to the epidemiology studies for chlorpyrifos that EPA used to make its Food Quality Protection Act (FQPA) determination for all organophosphate (OP) pesticides, but these data were not used by DPR to derive its point of departure for chlorpyrifos risk assessment. EPA scientists have not yet prepared a formal evaluation of the new animal studies for chlorpyrifos, but EPA's decision to deny the petition to revoke tolerances and cancel registrations for chlorpyrifos states that EPA intends to evaluate the new animal studies as part of its registration review deliberations for chlorpyrifos. The FIFRA registrations for chlorpyrifos may also be affected by pending judicial actions challenging EPA's decision to deny the petition to revoke the tolerances and cancel the registrations for chlorpyrifos. In this complicated environment, it will be important to monitor the registrants' and industry's response to DPR's cancellation actions, as well as their efforts on the pending Federal court litigation and EPA's registration review process for chlorpyrifos.

National Law Review, 17 August 2019

http://www.natlawreview.com

# Regulatory Update



## EUROPE

### A report calls for urgent changes to the way flame retardants and packaging additives are regulated

*2019-08-22*

A committee of MPs has heard that the UK's approach to chemical regulation is one of 'firefighting', and has called on the government to set ambitious targets for reducing toxic chemicals in the environment, including elimination of endocrine disruptors in consumer products. In a wide-ranging report, the Environmental Audit Committee details government inaction and delay, and the loss of expertise and funding in toxicology and environmental chemistry. Michael Depledge from Exeter University in the UK lays out the scale of the task, given that there are around 80,000 chemicals in common use: 'We try to make a regulation for each chemical that comes along—and we have about 2,000 new chemicals a year—but we can't get through them all. We have toxicity tested only a few per cent of the total amount, and we don't know how they interact in mixtures.' He adds that 'it is the integrated impact of the chemicals that we need to get to grips with'.

Persistent inaction

The report highlights two areas that the government needs to address: flame retardants, and chemicals used in packaging. It points out that regulations on flame retardants used in mattresses and sofas haven't been significantly revised in 30 years, and that government hasn't responded to consultations from as far back as 2010. During this time, it says, some of the most commonly used flame retardants have been classed as persistent organic pollutants and substances of very high concern. 'Inaction has allowed unnecessary and potentially toxic chemicals to continue to enter the public's homes,' the report says. Over 100 chemicals used in packaging are defined as human or environmental health hazards. The EU considers seven of the substances as persistent, bio-accumulative and toxic or very persistent, very bio-accumulative and a further 15 as endocrine disrupting chemicals. The MPs called on the government to automatically ban REACH-defined substances of very high concern in food contact materials, and to use the introduction of an extended producer responsibility (EPR) scheme for plastic packaging to phase out the use of chemicals in plastics that have been found to be toxic. They said the government was failing to protect consumers because the budget for product safety compliance

doesn't reflect the volume of products on the market, and recommended a 10% annual increase in funding.

Regrettable substitutions

Stuart Harrad, an environmental chemist at Birmingham University, UK, says the report draws attention to the way we regulate chemicals at a very important time. He welcomes the committee's recommendation that regulation should be speeded up by a grouping approach to substance evaluations. This would consider both structurally similar substances, and substances used for similar purposes, to avoid what are known as 'regrettable substitutions' – where one chemical is replaced by another related chemical that's not regulated and turns out to be similarly harmful. Ecotoxicologist Tamara Galloway from Exeter University told MPs that one means of avoiding such substitutions is to 'institute everything you can through green chemistry approaches', and to work with manufacturers to reduce the risks of substituted chemicals. The inquiry ran a small survey that showed consumers were both aware of and concerned about chemicals in consumer products, but the MPs heard evidence that a lack of labelling and transparency hindered them making informed choices. They recommend a reform of the labelling system for consumer products, so that groups of chemicals used are listed; as well as the development of domestic pictograms for substances of very high concern – indicating, for example, if chemicals used are carcinogenic or bio-accumulative.

Back to front measures

Andrew Watterson, from the occupational and environmental health group at Stirling University, UK, suggests that the report's approach to chemicals is 'back to front' in several places. 'You [should] go upstream to prevent your exposures, rather than try to label everything and do detailed biomonitoring work,' he tells *Chemistry World*, adding that 'we know enough to act on many concerns already' and that a biomonitoring programme 'can [now] be used as an excuse for not acting on many fronts'. The committee also heard extensive concerns about the provision for scientific advice to the Health & Safety Executive, which takes over chemicals regulation after Brexit. The Royal Society of Chemistry has suggested a register of specialists should be set up to support the government's decision- making processes. It said it was vital the UK works

collaboratively and internationally on chemicals regulation, and stressed it should prioritise harmonising regulations.

Chemistry World, 24 July 2019

https://www.chemistryworld.com</a

## Evaluation of confirmatory data following the Article 12 MRL review for oryzalin

*2019-08-22*

The applicant Dow AgroSciences submitted a request to the competent national authority in France to evaluate the confirmatory data that were identified for oryzalin in the framework of the maximum residue level (MRL) review under Article 12 of Regulation (EC) No 396/2005 as not available. To address the data gaps identified, residue trials on apples were submitted which are appropriate to conclude on the residue situation in kiwi fruits; furthermore, new residue trials on asparagus and on bananas were also provided. The information submitted to address the primary crop metabolism on asparagus was considered not sufficient to elucidate the nature of residues expected in asparagus. Thus, since the data gap for asparagus was not fully addressed, risk managers may consider the deletion of the existing MRL. For kiwi fruits and bananas, the previously derived MRLs do not have to be modified. Further information is available at: www.efsa.europa.eu

**The applicant Dow AgroSciences submitted a request to the competent national authority in France to evaluate the confirmatory data that were identified for oryzalin in the framework of the maximum residue level (MRL) review under Article 12 of Regulation (EC) No 396/2005 as not available.**

Chemycal, 16 August 2019

http://chemycal.com

## International Conference on Uncertainty in Risk Analysis

*2019-08-22*

The European Food Safety Authority (EFSA) and the German Federal Institute for Risk Assessment (BfR) organised the International Conference on Uncertainty in Risk Analysis. Its aim was to bring together internationally recognised leaders of uncertainty analysis in food safety, environmental, occupational, animal, and plant health and to start a holistic discussion of uncertainty: its cognitive basis, methods and approaches of analysis, communication and consideration in decision making, and in discourse with society. The conference was held from February 21-22, 2019 at the BfR in Berlin. On 20 February, the preconference workshops took place with in total four parallel workshops.

# Regulatory Update

In total, nearly 300 people participated in the conference,18% of them coming from outside the European Union. Most of the presentations were livestreamed. The importance of uncertainty analysis for scientific assessments, the associated implications for decision making, and the need to communicate the most relevant uncertainties to decision makers and to the broad public was emphasised. Three main conclusions were drawn: firstly, training can be helpful in improving understanding of uncertainty. Secondly, scientists have an ethical responsibility to communicate uncertainty. In the short term this may not necessarily result in increased public trust of scientific work but enables society to engage in more informed discourse which should lead to better understanding and trust in the longer term. Thirdly, the risk assessor needs to take active steps to avoid undetected sources of uncertainty: to discover potential surprises and take account of uncertainty arising from choices of model structure, the use of standard measures and even the unambiguous definition of the problem itself. Further information is available at: www.efsa.europa.eu

Chemycal, 16 August 2019

http://chemycal.com

## The applicability of the GHS classification criteria to nanomaterials

*2019-08-22*

The report reviews the applicability of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) hazard classification criteria to manufactured nanomaterials considering the recent data generated and compiled in the nanomaterial testing program under the OECD Working Party on Manufactured Nanomaterials. In addition, data from the EU NANoREG project, the EU NanoSafety Cluster projects, REACH registrations and publicly available literature were used. The project focused on four nanomaterials and selected health hazard classes. The available test data were evaluated with respect to applicability of the test methods, applicability of the GHS criteria, identified data gaps and uncertainties and need for revision of GHS criteria or guidance. The report also highlights specific issues to be considered when classifying nanomaterials.

Secretary of the Nordic Council of Ministers, 13 May 2019

http://norden.diva-portal.org

**The report reviews the applicability of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) hazard classification criteria to manufactured nanomaterials considering the recent data generated and compiled in the nanomaterial testing program under the OECD Working Party on Manufactured Nanomaterials.**

# REACH Update



## ECHA to prepare a restriction proposal on lead in ammunition and fishing tackle

*2019-08-23*

The European Commission has requested the European Chemicals Agency (ECHA) to develop an Annex XV dossier for a possible restriction on the placing on the market and use of lead in ammunition in terrestrial environments. The proposal aims to address concerns posed by gunshot used on land, bullets used both in wetlands and land areas, as well as lead in fishing tackle. ECHA has earlier proposed a restriction on the use of lead shots over wetlands. This proposal is currently with the Commission for decision making. Further information is available at: ECHA's current activities on restrictions

ECHA News, 21 August 2019

http://echa.europa.eu

**The European Commission has requested the European Chemicals Agency (ECHA) to develop an Annex XV dossier for a possible restriction on the placing on the market and use of lead in ammunition in terrestrial environments.**

## Aerospace and defence chromates reauthorisation – consortium launch meeting

*2019-08-23*

All companies in the European aerospace and defence supply chains are invited to attend the launch meeting of the Aerospace and Defence Chromates Reauthorisation (ADCR) Consortium in Brussels on 20 September 2019. This new consortium is dedicated to applying for the re-authorisation of the use of chromates in this sector. The ADCR focus includes redefining the scope of uses and applying for those uses where substitution has not yet been achieved. Active involvement of downstream users is a key objective. Further information is available at: More

ECHA News, 21 August 2019

http://echa.europa.eu

## New intentions to identify substances of very high concern

*2019-08-23*

The European Chemicals Agency (ECHA) has published new intentions to identify substances of very high concern. New intentions have been received for:

# REACH Update



- 4,4'-(1-methylpropylidene)bisphenol (EC 201-025-1, CAS 77-40-7), and
- Resorcinol (EC 203-585-2, CAS 108-46-3).

Further information of SVHC is available at: Registry of SVHC intentions until outcome

ECHA News, 21 August 2019

http://echa.europa.eu

## Take part in Biocides Day

*2019-08-23*

The European Chemicals Agency (ECHA) has issued an invitation to join the agency for its free Biocides Day on 29 October 2019. Biocides Day will provide an insight into the current priorities for biocides in the EU. The day will focus on active substance approval, endocrine disruptors and biocidal product families. Further information on the day is available at:

- More
- Register

ECHA News, 21 August 2019

http://echa.europa.eu

**The European Chemicals Agency (ECHA) has issued an invitation to join the agency for its free Biocides Day on 29 October 2019.**

## 6 REACH Testing proposal consultations launched

*2019-08-23*

On 16 August, the European Chemicals Agency published 6 REACH testing proposals for consultation. The consultation will run for 45-days for the following substances:

- Benzene, diethenyl- and Benzene, ethenylethyl- N,N'-dimethyldiphenylthiuram disulphide
- Reaction mass of 1,3-Propanediol, 2-(hydroxymethyl)-2-[(methoxymethoxy)methyl]- and 1,3-dioxane-5,5-dimethanol

Yorda's Hive, 20 August 2019

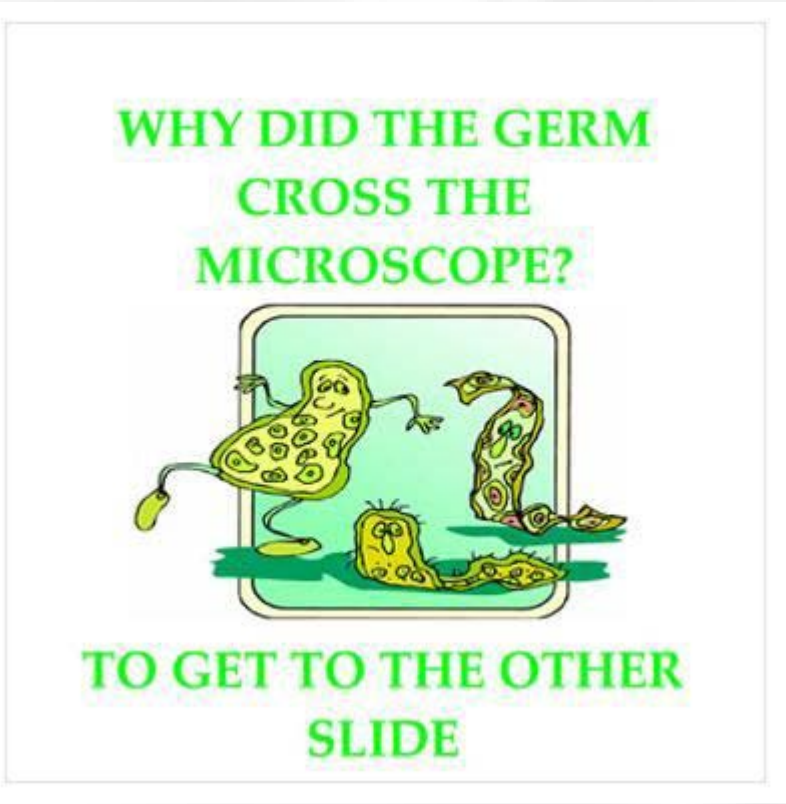
https://www.yordasgroup.com/hive/news

# Janet's Corner



## Why did the germ cross the microscope?

2019-08-23




Pinterest

https://www.pinterest.com.au

# Hazard Alert



## Phthalic Anhydride

*2019-08-12*

Phthalic anhydride is the organic compound with the molecular formula $C_8H_4O_3$. It is the anhydride of phthalic acid. [1] Phthalic anhydride occurs as white, lustrous crystalline needles, and has a characteristic pungent choking odour. It is soluble in hot water, benzene, carbon disulfide, and alcohol and is slightly soluble in water and ether. [2] Phthalic anhydride is obtained by catalytic oxidation of ortho–xylene or naphthalene. When separating the phthalic anhydride from production by products such as o–xylene in water, or maleic anhydride, a series of "switch condensers" is required. It can also be prepared from phthalic acid. [3]

### USES [2,4]

Phthalic anhydride is used in the manufacture of plasticisers, polyester and alkyd resins. It is also used in the manufacture of phthaleins, phthalates, benzoic acid, synthetic indigo, artificial resins, synthetic fibres, dyes, pigments, pharmaceuticals, and chlorinated products.

Phthalic anhydride is an important chemical intermediate in the plastics industry from which are derived numerous phthalate esters that function as plasticisers in synthetic resins. Phthalic anhydride itself is used as a monomer for synthetic resins such as glyptal, the alkyd resins, and the polyester resins. It is also used as a precursor of anthraquinone, phthalein, rhodamine, phthalocyanine, fluorescein, and xanthene dyes.

**Phthalic anhydride is the organic compound with the molecular formula C8H4O3.**

Phthalic anhydride is used in the synthesis of primary amines, the agricultural fungicide phaltan, and thalidomide. Other reactions with phthalic anhydride yield phenolphthalein, benzoic acid, phthalylsulfathiazole (an intestinal antimicrobial agent), and orthophthalic acid.

### ENVIRONMENTAL EFFECTS [4]

Phthalic anhydride is released to the environment from chemical plants, mainly those that manufacture the chemical or use it in the production of plastics and resins. The major sources of these releases are process off-gases and industrial effluents; however, the use of catalytic oxidation now reduces the release of pollutants in off-gases. Phthalic anhydride has been identified but not quantified in U.S. drinking water and in the volatile flavour components of baked Idaho potatoes. No information was found for the transport of phthalic anhydride in the environment or in soil.

However, in moist soil, the chemical will hydrolyse to phthalic acid and significant leaching is not expected to occur, other than in the case of a large spill. Phthalic anhydride is not expected to bioaccumulate in aquatic organisms. Plants and animals exposed to radiolabelled di-2-ethylhexyl phthalate (DEHP) in a microecosystem contained, but did not accumulate to any great extent, phthalic anhydride, a metabolite of DEHP.

## SOURCES & ROUTES OF EXPOSURE

### Sources of Exposure [5]

- Exposure to phthalic anhydride may occur during the manufacture of phthalate-derived products.
- It has been suggested that exposure to phthalic anhydride may occur from the use of plastics from which phthalate plasticisers are leached, specifically certain medical plastics such as blood bags, plastic syringes, and plastic tubing.
- Phthalate esters have been identified as environmental pollutants.

### Routes of Exposure [2]

The probable routes of exposure to phthalic hydride are:

- inhalation;
- ingestion; and
- skin and/or eye contact

## HEALTH EFFECTS [5]

### Acute Effects

- Phthalic anhydride is irritating to the eyes, respiratory tract, and the skin in humans, but no permanent injury is observed. Since phthalic anhydride has no effect on dry skin, but burns wet skin, it has been suggested that the actual irritant is phthalic acid, which is formed on contact with water.
- Tests involving acute exposure of rats have shown phthalic anhydride to have moderate acute toxicity.

### Chronic Effects

- Conjunctivitis, rhinitis, rhinoconjunctivitis, bronchitis, and irritation of the skin and mucous membranes of the respiratory tract have been observed in workers exposed to phthalic anhydride. Other effects

observed in workers chronically exposed to phthalic anhydride were occasional bloody sputum, emphysema, lower blood pressure, and minor signs of central nervous system (CNS) excitation.

- Animals exposed to heated phthalic anhydride experienced congestion, irritation, and injury of lung cells.
- Hypersensitivity of guinea pigs to phthalic anhydride dust has been reported, with bronchoconstriction, transiently increased respiratory rate, and elevated IgG antibodies observed following an inhalation challenge.
- Decreased body weight, increased incidence of lung and kidney lymphocytosis, bile duct inflammation, adrenal atrophy, and mineralization of the thalmus were reported in mice exposed to phthalic anhydride in the diet.
- EPA has calculated a provisional Reference Concentration (RfC) of 0.12 milligrams per cubic metre (mg/m3) for phthalic anhydride based on respiratory effects in humans.
- EPA has established a Reference Dose (RfD) of 2.0 milligrams per kilogram body weight per day (mg/kg/d) for phthalic anhydride based on lung and kidney effects in mice.

## Reproductive/Developmental Effects

- No studies regarding reproductive or developmental effects in humans were available.
- Phthalic anhydride was reported to be teratogenic in mice following intraperitoneal injection.
- Decreased spermatozoa motility time was reported in one study in which male rats were exposed via inhalation.

## Cancer Risk

- No studies were available on the carcinogenic effects of phthalic anhydride in humans.
- A bioassay of phthalic anhydride for possible carcinogenicity was conducted by administering phthalic anhydride in feed to groups of male and female rats and mice. It was observed that no tumours occurred in the rats or mice of either sex at incidences that could be clearly related to the administration of phthalic anhydride.
- EPA has not classified phthalic anhydride regarding carcinogenicity.

## SAFETY [6]

### First Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.
- Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

### Fire Information

- Phthalic anhydride may be combustible at high temperature.
- Auto-ignition temperature is 570°C
- Phthalic anhydride is slightly flammable to flammable in presence of heat and non-flammable in presence of shocks.
- For fighting small phthalic anhydride fires, use dry chemical powder.
- For fighting large fires, water spray, fog or foam should be used. Do not use water jet.

## Exposure Controls & Personal Protection

### Engineering Controls

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

### Personal Protective Equipment

The following personal protective equipment is recommended when handling phthalic anhydride:

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

Personal Protective Equipment in Case of a Large Spill:

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

## REGULATION

### United States [7]

NIOSH: The National Institute for Occupational Safety and Health has set a recommended exposure limit (REL) for phthalic anhydride of 6 mg/m3 and 1 ppm TWA

OSHA: The Occupational Safety & Health Administration has set a permissible exposure limit (PEL) for phthalic anhydride of 12 mg/m3 and 2 ppm TWA

**Australia [8]**

Safe Work Australia: Safe Work Australia has established a time weighted average concentration (TWA) for phthalic anhydride of 6.1 mg/m3 and 1 ppm for a 40-hour work week.

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# Gossip



## Put a charge on it

*2019-08-14*

Pollutants coming out of cars' exhausts are harmful to the environment and public health. With the goal of overall curbing car emissions, the US Department of Energy (DOE) issued a challenge to scientists worldwide: catalytically converting 90% of all critical pollutants (hydrocarbons, CO, NOx etc.) in car exhaust into less harmful substances at 150ºC. However, nanoparticle based heterogeneous catalysts - like the three-way exhaust catalyst used in cars - work best at high temperatures (between 200 and 400ºC), thus making the 150ºC DOE challenge seem difficult to attain. Now, researchers from the López Group, have studied in detail the behaviour of Pt single atoms supported on CeO2 - what the researchers argue would outperform the Pt nanoparticles supported on CeO2 currently employed in the three-way exhaust catalyst. The results, published in Nature Materials, show that the common assumption of a static charge in Single-Atom Catalysis is oversimplified. Instead, the scientists propose a dynamic charge, able to explain the unique reactivity found for activated single platinum atoms on ceria, which in turn can perform CO-oxidation meeting the DOE 150ºC challenge for emissions. Dynamic charge and oxidation state Since Single-Atom Catalysis field flourished, scientists have been working to understand the intimate behaviour at the interface between Single-Atom Catalysts and the oxides supporting them, hoping this knowledge will allow the tuning of their catalytic activity. The scientists from the López Group combined Density Functional Theory (DFT) and first-principles Molecular Dynamics (BOMD) to elucidate what is exactly going on at the interface. The simulations revealed a metastable system where the Pt atoms have several overlapping oxidation states, allowing the catalyst to shift from one state to another. These dynamically interconnected oxidation states are "a completely new concept," as Nathan Daelman, first author of the study, explains. For the scientists, it's clear the dynamic behaviour influences the reactivity of the system and, for the first time, they have been able to explain the Pt activation step needed for the three-way exhaust catalysts to properly function under DOE 150ºC working conditions. To the researchers, the next steps will be working to prepare a model of the mechanism that will be able to predict with temperature the behaviour of the catalytic system.

**Scientists from the López Group propose a dynamic charge and oxidation state for Single-Atom Catalysts**

EurekAlert, 5 August 2019

http://www.eurekalert.org

# Gossip



## A wearable device so thin and soft you won't even notice it

*2019-08-14*

Wearable human-machine interfaces - devices that can collect and store important health information about the wearer, among other uses - have benefited from advances in electronics, materials and mechanical designs. But current models still can be bulky and uncomfortable, and they can't always handle multiple functions at one time. Researchers reported on 2 August, the discovery of a multifunctional ultra-thin wearable electronic device that is imperceptible to the wearer. The device allows the wearer to move naturally and is less noticeable than wearing a Band-Aid, said Cunjiang Yu, Bill D. Cook Associate Professor of Mechanical Engineering at the University of Houston and lead author for the paper, published as the cover story in Science Advances. "Everything is very thin, just a few microns thick," said Yu, who also is a principal investigator at the Texas Centre for Superconductivity at UH. "You will not be able to feel it." It has the potential to work as a prosthetic skin for a robotic hand or other robotic devices, with a robust human-machine interface that allows it to automatically collect information and relay it back to the wearer. That has applications for health care - "What if when you shook hands with a robotic hand, it was able to instantly deduce physical condition?" Yu asked - as well as for situations such as chemical spills, which are risky for humans but require human decision-making based on physical inspection. While current devices are gaining in popularity, the researchers said they can be bulky to wear, offer slow response times and suffer a drop in performance over time. More flexible versions are unable to provide multiple functions at once - sensing, switching, stimulation and data storage, for example - and are generally expensive and complicated to manufacture. The device described in the paper, a metal oxide semiconductor on a polymer base, offers manufacturing advantages and can be processed at temperatures lower than 300 C. "We report an ultrathin, mechanically imperceptible, and stretchable (human-machine interface) HMI device, which is worn on human skin to capture multiple physical data and also on a robot to offer intelligent feedback, forming a closed-loop HMI," the researchers wrote. "The multifunctional soft stretchy HMI device is based on a one-step formed, sol-gel-on-polymer-processed indium zinc oxide semiconductor nanomembrane electronics."

**Device also can serve as robotic skin, relaying information back to the user**

EurekAlert, 2 August 2019

http://www.eurekalert.org

# Gossip



## Simulation technique predicts microstructures of alloys used in jet engines—before they are made

*2019-08-14*

Japanese researchers were able to rapidly and accurately predict the microstructure of Nickel-Aluminium (Ni-Al) alloys that are commonly used in the design of jet engine turbine parts. Predictions of the microstructure of these alloys have so far been time-consuming and expensive. The findings have the potential to greatly advance the design of materials—made up of a range of different alloys—that are used to make products in several different industry sectors. Alloys are durable materials made up of two or more metals. The current high cost and design limitations of traditional alloy manufacturing processes have driven the need to create more efficient design methods. One key challenge has been how to accurately predict an alloy's microstructure (the very small-scale structure that is only visible by microscope) which can greatly influence physical properties such as strength, toughness, resistance to corrosion, hardness and/or wear and tear resistance. The authors were able to predict alloy microstructures by using the "first-principle phase field method." This procedure predicts the microstructure of alloys based on the fundamental laws of physics alone (first principles) and then uses those parameters to model microstructure formations (phase field). This is contrary to empirical modelling, or predictions based on experiments or previous observations alone. Furthermore, the researchers conducted their modelling experiments under high temperatures that mimic those of jet engine turbines (~1027oC). The research was published in Nature Communications on 1 August 2019. The quest of new materials with desirable properties requires microstructure engineering of materials based on changing several variables, such as composition, morphology, pressure, temperature, doping, casting and forging. A reliable simulation technique that can help with the design and production of new materials based on a theoretical principle alone could make production faster and cheaper. However, most of the current theories of material design are phenomenological and derived from experimental observations and empirical experiences. These are both time-consuming and expensive. What makes the first-principles phase field method so advantageous, according to the authors, is that it bridges the accurate small-scale (first principles) calculations and large-scale (phase field) model by renormalisation theory, a concept in physics that essentially makes infinite degrees of freedom finite, or continuous variables discrete. In other words, by using their method, they were able to overcome time-consuming and expensive experimental procedures and still produce materials that were

**The new "First-principles phase field" method to better predict complex microstructures of alloys.**

in agreement with experimental methods. "First-principles phase field method was invented as the world's first innovative multiscale simulation technique. Using this method, we were able to successfully predict complex microstructures of any compositions of Ni-Al alloys from first-principles (basic laws of physics) without using any empirical parameter, and our results agree quite well with experiments," says Kaoru Ohno, corresponding author and professor at Yokohama National University. Ohno and co-authors from the National Institute for Materials Science in Japan say the method can be used to predict mechanical strength of alloys because the local force distributions as well as the microstructures can be easily calculated. The method that the authors present can also be used to predict microstructures of multicomponent alloys, or alloys that are made up of more than two metals. "These studies highlight the fundamental nature of steels and other alloys that have so far only been demonstrated based on empirical observations. As such, the proposed method is a powerful theoretical tool to quickly predict the most suitable alloy that can realize the desired strength, toughness, ductility, plasticity, lightness, etc. as much as possible," adds Ohno. In the future, the authors plan to apply the method to various steel materials and other multicomponent alloys in order to predict the dependence of microstructures and local stress distributions on their initial compositions and better understand their characteristics.

Phy.org, 1 August 2019

http://phys.org

**An acid used for medicine and to flavour some drinks soon may help make electronic components and certain adhesives more durable and better for the environment.**

## Acid may be key ingredient for better adhesive strength, electronic components

*2019-08-14*

Purdue University researchers have discovered a method for using tannic acid to help create improved adhesives, coatings and manufacturing composites. The Purdue team is using its discovery for epoxy-based polymers—which are considered among the most versatile and useful adhesive agents because of their excellent mechanical strength and strong sticking power. "There are few high-temperature hardeners that are sustainable," said Jeffrey Youngblood, a professor of materials engineering in Purdue's College of Engineering. "Our technology is designed to improve sustainability without sacrificing performance." Epoxy polymers are used in a wide range of applications including coatings, adhesives, structural composites, insulating materials and components of electronics. A hardening agent is added to the polymer to ensure stability and stiffness

in high-temperature environments. "We are using tannic acid as the hardener," Youngblood said. "It is more sustainable than other options, has less environmental impact and is relatively inexpensive." Tannic acid is a well-known, naturally occurring polyphenolic compound used in antioxidants. Youngblood said the team's tannic acid solution also has shown in testing to be stable and maintain needed stiffness when exposed to high temperatures. The other members of the research team include John Howarter, an associate professor of engineering, and Matthew Korey, a National Science Foundation graduate research fellow. "My research group is heavily involved in developing sustainable materials," he said. "Sustainable materials typically have lower performance, which compromises the public perception and penetration into the market. Here, such a trade-off is not necessary." Youngblood previously worked on technology involving tannic acid to help make materials flame-retardant. He said this new discovery opens opportunities to continue that research into using tannic acid for fire retardancy.

Phys.org, 1 August 2019

http://phys.org

## New type of pipe for pumping blood is just liquid with no pipe

*2019-08-14*

Getting fluid to flow through tiny pipes without being damaged or slowed down is a tricky problem that comes into play in all sorts of places, including in some parts of the blood pumps used during heart surgery. The problem is that walls create friction – so why not just get rid of them? A new type of liquid pipe does just that, allowing water or blood to flow through it with nearly zero friction. The liquid tubes were made using a ferrofluid, a liquid containing suspended magnetic particles. Thomas Hermans at the University of Strasbourg in France placed some of this liquid inside a plastic case lined with magnets. By manipulating the ferrofluid with the magnets, a channel in the centre was created where another fluid can flow. It's a bit like a garden hose full of water, with the hose stripped off and replaced with another liquid. The device is known as the QPump. But the liquid tubes themselves have a better name: "We call them anti-tubes," says Hermans. They are not just a gimmick. Hermans and his colleagues tested this liquid-in-liquid flow by passing several materials through the device. In one test, they found that honey flowed 70 times faster through their ferrofluidic channels than through a conventional plastic tube of the same diameter. This could come in handy

for studying fluid dynamics, or in pharmaceutical processes that involve manipulating lots of liquids in small amounts. By rapidly adding and removing magnets, the fluid inside the liquid tube can be forced to flow, in a similar way to the rollers used in peristaltic pumps. "We went to an open-heart surgery, which was interesting to see, for a chemist," Hermans says. "The cardiologists showed us what type of pumps they used to pump blood through the heart. With those, the red blood cells can break, and haemoglobin is released into blood plasma, which triggers all kinds of bad things for the patient." In tests using the QPump, Hermans and his team found that the breakdown of haemoglobin in whole human blood was about 11 times lower than in a traditional peristaltic pump. "It does allow you to do a peristaltic flow in a gentle way," says Thomas Russel at the University of Massachusetts Amherst. "It's unlike other things we've seen in the sense that the system is entirely liquid. There's no solid, so you effectively have no hard walls." He adds that the system may be susceptible to interference from other magnetic fields, but future tests would have to confirm that. Hermans says he and his team are planning experiments to test the effects of using this pump on blood in mice next.

New Scientist, 1 August 2019

http://www.newscientist.com/

## Scientists Create Tiny Magnetic Coils That Could Break Down Plastic in The Ocean

*2019-08-14*

**In a new study, scientists describe a new type of nanotechnology: tiny magnetic "nano-coils" that create chemical reactions in order to break down micro-plastics in the ocean.**

There are more pieces of plastic in the ocean than stars in the Milky Way galaxy. Up to 14 million tons of plastic enters the ocean annually, 40 percent of which is considered "single-use", which means it goes into the water within the same year that it was produced. Most plastics never fully break down; they just fragment into smaller pieces called microplastics (5 millimetres across or smaller). Microplastics have been found in every corner of the globe, from the deepest part of the Mariana Trench to the top of the French Pyrenees. Addressing this plastic pollution problem, of course, requires limiting plastic production. But innovators are also exploring ways to clean up plastic and microplastic that's already in the ocean. In a new study published in the journal Matter, scientists describe a new type of nanotechnology that could help: tiny magnetic "nano-coils" that create chemical reactions in order to break down microplastics in the ocean. The process converts the plastic into carbon dioxide and water. Xiaoguang Duan, a co-author of the new study, told Business Insider that

although the technique is still in its infancy, the study "provides a possible solution to tackle a global problem."

Tiny magnetic coils could erode microplastic

Nano-tech refers to anything smaller than one billionth of a metre, or half the width of a human hair. In this case, Duan and his team created microscopic nanotubes made of carbon and shaped like bed springs (which is why they're called nano-coils). The tubes are coated with nitrogen and a magnetic metal called manganese. These two chemical compounds interact with the nano-coils to create highly reactive oxygen molecules, which in turn attack microplastics. The process converts the plastic pieces into harmless salt compounds, Co2, and water. Duan and his team added the nano-coils to water samples contaminated with microplastic pollutants, and observed a 30 percent to 50 percent reduction in microplastics over a period of eight hours. The scientists then easily removed the nano-coils from the water using magnets for later re-use. Duan said more testing is needed before this technology could be ready to use in wastewater treatment plants or the ocean, but that's their goal in the long-term. "Our current study is still at a proof-of-concept stage in a lab scale," he said.

Microplastics are ubiquitous

Alarming quantities of microplastic have been found in a number of unexpected places, including scarcely populated islands in the Indian Ocean (where scientists found upwards of 414 million pieces of trash) and the guts of tiny animals living in the deepest part of the Pacific Ocean, some 36,000 feet down. A 2015 study estimated that there's between 15 and 51 trillion pieces of microplastic in the world's oceans, weighing up to 261,000 tons. Microplastics are a problem for marine life: A 2013 study found that marine animals can accumulate potentially hazardous chemicals from eating those plastics. That can lead them to suffer from tumours and liver problems. Much of the fish and shellfish we ingest contain microplastics, and the tiny pollutants have shown up in our poop, according to the Smithsonian Institute. Scientists don't yet know the full consequences microplastics pose to human health.

Solving the plastic problem

Duan's team isn't the only one researching potential solutions to the plastic crisis. Boyan Slat, a 24-year-old entrepreneur, launched The Ocean Clean-up project six years ago. His organisation aims to clean up the Great Pacific Garbage Patch, a trash-filled vortex more than twice the

size of Texas. The project's 2,000-foot-long (600-metre-long) plastic-catching tool was re-launched in June after an initial attempt last year proved unsuccessful. Another option, from the winner of Google's 2019 Science Fair, is similar to what Duan's team is proposing. Fionn Ferriera, an 18-year-old from Cork County, Ireland, found that by combining oil with a magnetic compound called magnetite and adding that solution to water, he was able to extract about 90 percent of microplastics in water using magnets. "At this stage, I believe all the possible solutions should be considered and encouraged," Duan said. But he added that none of these innovations should be seen as an excuse to continue ramping up the production and use of single-use plastics. "Prevention is always the best solution," he said.

Science Alert, 10 August 2019

http://www.sciencealert.com.au

## Earth's Last Magnetic Pole Flip Happened Much More Slowly Than We Thought

*2019-08-14*

**New research suggests Earth's most recent magnetic field reversal took longer to complete than previously thought: around 22,000 years in total.**

New research suggests Earth's most recent magnetic field reversal took longer to complete than previously thought: around 22,000 years in total. Figuring out why this particular flip was so drawn out will let us better understand this mysterious process, and maybe even help us to prepare. It's a fact geologists know about our planet: every few hundred thousand years or so, Earth's magnetic field quite literally flips – so the magnetic north is at the South Pole, and vice versa. It's important to establish the timings of these reversals so we know how much of a window we have to potentially adapt for the next one. With so many modern-day systems like GPS reliant on knowing north from south, a flip could easily cause chaos one day. Earth's magnetic field is created by the planet's liquid iron outer core spinning around its solid inner core. Charting magnetic field reversals back through time isn't easy, but clues can be found in ocean sediments and lava flows that lock in the direction and the strength of the magnetic field at the time they emerged. "Lava flows are ideal recorders of the magnetic field," says geologist Brad Singer, from the University of Wisconsin-Madison. "They have a lot of iron-bearing minerals, and when they cool, they lock in the direction of the field." "But it's a spotty record. No volcanoes are erupting continuously. So, we're relying on careful field work to identify the right records." Singer and his colleagues looked at lava flow records from Chile, Tahiti, Hawaii, the Caribbean and the Canary Islands, looking at the timing of the most recent reversal. Named the Matuyama-

# Gossip



Brunhes reversal after the scientists who discovered magnetic field flips, it happened about 770,000-780,000 years ago. That timing suggests we're 'overdue' for a reversal right now – although we may just be in a period of instability that doesn't result in a full flip (something that's happened before, too). There's currently some debate over how long the next reversal will last. Based on the lava rock records, the researchers found that the main part of the Matuyama-Brunhes event lasted 4,000 years, but was preceded by 18,000 years of instability and excursions (those temporary, partial reversals). The findings were backed up by an analysis of rocks from the ocean floor, a more continuous but less precise record of Earth's magnetic field. This time frame is longer than previous estimates, and hints that we won't suddenly be surprised by a relatively quick flip. We still don't know for sure how long the next flip might last – or exactly when it's coming – but we do now have a wealth of extra data to help scientists make their best estimations. If we're in for another Matuyama-Brunhes reversal, this study suggests it's going to last for many generations. When the time does come, our planet's magnetic field is going to be weaker and more complicated than it is now, so it's vital that we're prepared. "Reversals are generated in the deepest parts of Earth's interior, but the effects manifest themselves all the way through the Earth and especially at Earth's surface and in the atmosphere," says Singer. "Unless you have a complete, accurate and high-resolution record of what a field reversal really is like at the surface of Earth, it's difficult to even discuss what the mechanics of generating a reversal are." The research has been published in Science Advances.

Science Alert, 9 August 2019

http://www.sciencealert.com.au

**Wearable environmental sensors, smart devices, and mobile health technologies aim to rein in childhood form of the lung disease**

## Predicting asthma attacks in kids

*2019-08-14*

Millions of children have trouble controlling asthma attacks, leading to missed school days and scary trips to the emergency room. What if you could predict when a child will have an asthma attack and take steps to prevent it? That is what a multidisciplinary group of researchers at the University of California, Los Angeles, and the University of Southern California is hoping to do with the help of new wearable environmental sensors, smart devices, and mobile health technologies. Paediatric asthma is the most prevalent chronic childhood disease in the United States, says Alex Bui, director of medical imaging informatics and director of the Los Angeles Paediatric Research Using Integrated Sensor Monitoring Systems

(PRISMS) Centre at UCLA. Many things can play a role in asthma attacks. "It's not just air pollution," Bui says. Other contributors include common allergens, individual susceptibility factors, and behavioural factors. "Even though we treat asthma as a single disease, we often really need to get to the point of having more individually tailored care for it to be effective," Bui says. The Southern California team is building an informatics platform that integrates commercially available air pollution sensors as well as wearable environmental sensors developed by academic researchers. The project is part of the PRISMS initiative established in 2015 by the US National Institutes of Health. Information from the sensors, along with a person's geolocation, physical activity, and health data, is wirelessly transmitted to the person's smart watch and smartphone in real time. Participants use the smartphone to self-report symptoms and information related to daily activities. The informatics platform also uses the individual's location to integrate weather, traffic, and air-quality data into the data stream. The idea is to provide researchers with more detailed information about individual children with asthma to support epidemiological studies, says Bui, who is leading the effort to develop the informatics platform. Researchers can analyse the data to build models for predicting exposure scenarios that lead to asthma exacerbation for a particular individual. Participants can use such information to avoid certain situations or to know when to take control medication and carry an emergency inhaler.
Southern California researchers are testing an informatics platform that integrates data from air-quality sensors, smart devices, and mobile health technologies to better understand childhood asthma. A team led by Rima Habre, an assistant professor of clinical preventive medicine at the University of Southern California's Keck School of Medicine, tested the platform last year in an epidemiological pilot study. The researchers recruited 20 children aged 8–16 with moderate to severe asthma. The children carried and wore various devices and answered questions on a smartphone for 1 week. During the day, the children wore a smart watch that used low-energy Bluetooth to connect to the sensors and that served as a hub for the various devices, Bui says. The smart watch also provided information about the child's activity level and physiological measures, such as heart rate. The children also wore a palm-sized commercial air-quality monitor, called an AirBeam, for measuring airborne particulate matter with a diameter less than 2.5 µm (PM2.5). Such particles are the most dangerous to health because they can penetrate deep into the lungs. They clipped the sensor to their backpack or belt during the day and could place it nearby in the same room while at home. They carried an inhaler that doubled as a medication sensor; it notified the informatics platform when the inhaler delivered control or rescue medication. In addition, the

children measured their lung function twice a day, once in the morning and once in the evening, with a Bluetooth-enabled spirometer that determined the volume of air exhaled as a function of time. The children's gear also included a smartphone, which provided a larger screen for answering survey questions, extra computational power, and encryption to make the data framework more secure. The smartphone–smart watch combination provided researchers with GPS data to track an individual's location. To engage the children, the researchers created an animated dragon that showed up on the smartphone when the children needed to answer questions related to certain events. The questions provided researchers with more information about what an individual was doing. For example, "If a personal sensor on a child finds PM levels have gone up in the environment, the smartphone may issue a quick questionnaire asking the child: What is going on in the environment? Are you near a stove? Are you near a freeway?" Bui says. When a child answered questions on the smartphone, the dragon was happy. When questions were unanswered, the dragon got hungry and wanted to be fed answers. To encourage children to answer questions, the researchers gave them a gift card at the end of the study in an amount tied to their compliance in answering the questions. "We end up with a very highly correlated set of spatial and temporal information about where the individual is at any given point in time and what is happening with the individual," Bui says. "We can put all of this together to try and build more individually tailored predictive models of what is happening." The researchers used feedback and exit surveys from participants in the 2018 study to improve the platform in terms of colour and usability of the sensors. They are now testing the system in a formal epidemiological study launched in February, with a goal of recruiting 40 kids with moderate to severe asthma and monitoring them for 2 weeks. So far, at least 26 participants have enrolled in the study, Habre says. Even though we treat asthma as a single disease, we often really need to get to the point of having more individually tailored care for it to be effective. They are also testing three environmental sensors which were developed as part of the PRISMS program, in a real-life setting with kids with asthma. One of the new sensors is a wrist-worn device developed by researchers at Arizona State University for monitoring ozone. Another sensor, developed by researchers at Columbia University and AethLabs, measures black carbon and brown carbon, which are markers of air pollution generated by different types of combustion. A third sensor, developed by researchers at the University of Washington, detects particulate matter. The UW sensor can also collect small particles from sources such as diesel, wood smoke, and cigarettes for later analysis. The researchers are continually tweaking the platform,

making improvements as they learn "what is working and what is not working," Habre says. For example, the team learned that low-cost sensors need to be calibrated more frequently than sensors the researchers were used to. People also experience a lot of PM2.5 peaks during the day, Habre says. "Do we want to show people these peaks that might trigger some kind of false alarm when we don't know what it means for their health?" she asks. The researchers show participants hourly aggregate levels on a map to make the data "visually interesting," Habre says. The researchers are still struggling with privacy issues related to GPS data. "You can really derive a lot about an individual's behaviour just from looking at their GPS data," Habre says. Because of the potential benefits, many subjects are not worried about being tracked, she adds. "Mobile health approaches have amazing potential" to help researchers understand individual exposures, Habre says. These approaches are making it possible "to understand how multiple exposures, behaviours, stressors, and ecological factors all work together to affect asthma."

Chemical & Engineering News, 11 August 2019

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

## Supercapacitors turbocharged by laxatives

*2019-08-14*

An international team of scientists, including a professor of chemistry from the University of Bristol, has worked out a way to improve energy storage devices called supercapacitors, by designing a new class of detergents chemically related to laxatives. Their paper, published today in the journal Nature Materials, explains why these detergents, called ionic liquids, are better electrolytes than current materials and can improve supercapacitors. Currently, aqueous and organic electrolytes are used, but more recently, researchers and manufacturers have been testing ionic liquids instead to boost performance. Although ionic liquids are salts, at room temperature they are surprisingly not crystalline solids—as their name suggests they are in fact liquids. This gives ionic liquids numerous advantages over conventional electrolytes because they are stable, non-flammable, and often much more environmentally friendly. To explore the exciting potential offered by ionic liquids for emerging electrochemical technologies the authors designed a new set of highly efficient detergent-like ionic liquid electrolytes and explained how they work at electrode surfaces. Understanding how they operate will help design even more efficient devices for storing electrical energy. Professor Julian Eastoe, from the University of Bristol's School of Chemistry, is a co-author of the

**An international team of scientists, including a professor of chemistry from the University of Bristol, has worked out a way to improve energy storage devices called supercapacitors, by designing a new class of detergents chemically related to laxatives.**

study. He said: "To make this discovery required a team of scientists with a very diverse skill set, spanning chemical synthesis, advanced structural, microscopy and electrical techniques as well as computational methods. "This work demonstrates the power of scientific research 'without borders', the groups from different nations contributed their own expertise to make 'the whole greater than the sum of parts'." Co-author, Xianwen Mao, from the Massachusetts Institute of Technology (MIT), added: "We engineered a new class of ionic liquids that can store energy more efficiently. "These detergent-like ionic liquids can self-assemble into sandwich-like bilayer structures on electrode surfaces. And that is very reason why they give better energy storage performance." Typically, for electrolytes in contact with a charged electrode, the distribution of ions is dominated by electrostatic Coulombic interactions. However, this distribution can be controlled by making the ionic liquids soap-like, or amphiphilic, so that the molecules now have separate polar and non-polar domains, exactly like common detergents. These soap-like electrolytes then spontaneously form bilayer structures on the electrode surfaces, leading to much improved energy storage capabilities. The researchers found that temperature and applied voltage also affect the energy storage performance. This new class of electrolytes may be suitable for challenging operations, such as oil drilling and space exploration, but they may also pave the way to new and improved supercapacitors in hybrid cars. These devices are essential components in modern hybrid cars and can outperform batteries in terms of higher power and better efficiency. This is particularly the case during regenerative braking where mechanical work is turned into electrical energy, which can be stored quickly in supercapacitors ready to be released. This reduces energy consumption and is much more environmentally friendly. More importantly, using the new electrolytes such as developed in this study, future supercapacitors may even be able to store more energy than batteries, potentially replacing batteries in applications such as electrical vehicles, personal electronics, and grid-level energy storage facilities.

Phys.org, 12 August 2019

http://phys.org

**If humans could split water using cheap materials like nature did, society would have an endless supply of cheap hydrogen fuel for transportation, without carbon emissions.**

## Cheap renewable energy: Cracking the photosynthetic process that enables plants to split wat

*2019-08-14*

Scientists have cracked a key step in nature's water-splitting recipe, which powers all plant life on Earth and may be harnessed to make a limitless

supply of cheap renewable fuel. The Australian National University (ANU) and the Max Planck Institute for Chemical Energy Conversion (MPI-CEC) in Germany led the study, which for the first time identifies an important photosynthetic process that enables plants to split water. Lead researcher Dr. Nick Cox said if humans could split water using cheap materials like nature did, society would have an endless supply of cheap hydrogen fuel for transportation, without carbon emissions that contribute to human-caused climate change. "Enough sunlight hits the Earth in a single hour to power all human activity for over a year," said Dr. Cox from the ANU Research School of Chemistry. "Plants use this harvested energy to split water and make complex carbohydrates which provide food for the plant to grow and thrive. This process also enriches our atmosphere with oxygen for animals, including humans, to breathe. "Copying this process from nature would lead to new and improved renewable energy storage technologies." MPI-CEC researcher Dr. Maria Chrysina said the study revealed how a key enzyme involved needed to 'breathe' to allow access to water. "Half-way through its reaction cycle the enzyme develops the ability to stretch like a concertina, which enables the orderly uptake of water to begin the splitting process," Dr. Chyrsina said. ANU co-researcher Dr. Eiri Heyno said water splitting in nature could be hindered without the critical step identified by the team. "Without the careful, sequential binding of water, more reactive oxygen molecules can potentially be released that could unravel the whole water-splitting process," Dr. Heyno said. The study, which also involved researchers from Sweden, is published in Proceeding of the National Academy of Sciences of the United States of America. The research team used a technique called electron paramagnetic resonance (EPR) spectroscopy, which created 3-D images of the reactive site involved in photosynthesis process. Dr. Cox is leading the establishment of a new state-of-the-art EPR facility at ANU, with support from the Australian Research Council (ARC), University of New South Wales, University of Queensland, University of Sydney and University of Wollongong. "This new facility will operate at much higher magnetic fields than what's possible today, allowing more detailed measurements to be taken for medical, biological, chemical and materials research, as well as industrial applications," he said.

Phys.org, 7 August 2019

http://phys.org

# Gossip



## New retroreflective material could be used in night-time colour-changing road signs

*2019-08-14*

A thin film that reflects light in intriguing ways could be used to make road signs that shine brightly and change colour at night, according to a study that will be published on 9 August in Science Advances. The technology could help call attention to important traffic information when it's dark, with potential benefits for both drivers and pedestrians, researchers say. The film consists of polymer microspheres laid down on the sticky side of a transparent tape. The material's physical structure leads to an interesting phenomenon: When white light shines on the film at night, some observers will see a single, stable colour reflected back, while others will see changing colours. It all depends on the angle of observation and whether the light source is moving. The research was led by Limin Wu, Ph.D., at Fudan University in China, whose group developed the material. Experts on optics at the University at Buffalo made significant contributions to the work, providing insight into potential applications for the film, such as employing it in night-time road signs. "You can use this material to make smart traffic signs," says Qiaoqiang Gan, Ph.D., an associate professor of electrical engineering in the UB School of Engineering and Applied Sciences and a co-first author of the new study. "If a person is listening to loud music or isn't paying attention while they're walking or driving, a colour-changing sign can help to better alert them to the traffic situation."

**A thin film that reflects light in intriguing ways could be used to make road signs that shine brightly and change colour at night, according to a study that will be published on 9 August in Science Advances.**

Testing colour-changing road signs at night

In one set of experiments, researchers created a speed limit sign with letters and numbers made from the new film. The scientists placed a white light nearby to illuminate the sign, and when a fast-moving car drove past, the colour of the characters on the sign appeared to flicker from the perspective of the driver as the driver's viewing angle changed. In other tests, the team applied the new material to a series of markers lining the side of a road, denoting the boundary of the driving lane. As a car approached, the markers lit up in bright colours, reflecting light from the vehicle's headlights. From the driver's perspective, the markers' colour remained stable. But to a pedestrian standing at the side of the road, the colour of the markers appeared to flicker as the car and its headlights sped past. "If the car goes faster, the pedestrian will see the colour change more quickly, so the sign tells you a lot about what is going on," says co-

author Haomin Song, Ph.D., UB assistant professor of research in electrical engineering.

Phys.org, 9 August 2019

http://phys.org

## Nanosecond pulsed electric fields activate immune cells

*2019-08-14*

Nanosecond pulsed electric fields (nsPEFs) produce strong electrical effects by focusing a high-powered electrical pulse over a very short period of time. They are attracting attention as a method of physically stimulating matter in various fields, particularly in the life sciences. Recently, researchers from Kumamoto University in Japan found that stimulating immune cells with nsPEFs can cause them to respond as if they were being stimulated by bacteria. Researchers from the Institute of Pulsed Power Science (IPPS) selected a human leukemia cell line that is frequently used to study blood cell differentiation, the HL-60 cell line, to test the effects of nsPEFs on immune cells. First, they differentiated the cells into neutrophils, the most abundant type of white blood cell. Neutrophils play an important role in the immune system because they use phagocytosis, secretions of antimicrobial proteins, and neutrophil extracellular traps (NETs) to kill bacteria infecting the body. NETs are created from neutrophil DNA that is released from their nucleus. This then forms an extracellular fibrous network that entraps bacteria and increases the local concentration of antimicrobials. The researchers then analysed neutrophil and undifferentiated HL-60 cell responses to nsPEF exposure where they observed chromosomal DNA being released from neutrophils, and a special modification reaction called citrullination occurring in histones. Since these reactions only occurred in the neutrophils, the researchers considered these cellular responses to be equivalent to the formation of NETs that form when neutrophils are stimulated by bacteria. In other words, they seem to have found a way to stimulate neutrophils using nsPEFs to cause an immune cell response to bacteria without actually using bacteria. "Many studies have shown that nsPEFs are promising for cancer treatment applications," said study leader, Professor Ken-ichi Yano from Kumamoto University's IPPS. "Our research has shown that nsPEFs can also be used to stimulate cells to determine their function. We believe this has a wide range of potential biomedical applications."

**Nanosecond pulsed electric fields are strong electrical pulses over a very short period of time (nanoseconds) that results in high electrical power.**

Science Daily, 7 August 2019

http://www.sciencedaily.com

# Gossip



## Antineutrino detection could help remotely monitor nuclear reactors

*2019-08-14*

Technology to measure the flow of subatomic particles known as antineutrinos from nuclear reactors could allow continuous remote monitoring designed to detect fuelling changes that might indicate the diversion of nuclear materials. The monitoring could be done from outside the reactor vessel, and the technology may be sensitive enough to detect substitution of a single fuel assembly. The technique, which could be used with existing pressurised water reactors as well as future designs expected to require less frequent refuelling, could supplement other monitoring techniques, including the presence of human inspectors. The potential utility of the above-ground antineutrino monitoring technique for current and future reactors was confirmed through extensive simulations done by researchers at the Georgia Institute of Technology. "Antineutrino detectors offer a solution for continuous, real-time verification of what is going on within a nuclear reactor without actually having to be in the reactor core," said Anna Erickson, associate professor in Georgia Tech's George W. Woodruff School of Mechanical Engineering. "You cannot shield antineutrinos, so if the state running a reactor decides to use it for nefarious purposes, they can't prevent us from seeing that there was a change in reactor operations." The research, to be reported August 6 in the journal Nature Communications, was partially supported by a grant from the Nuclear Regulatory Commission (NRC). The research evaluated two types of reactors, and antineutrino detection technology based on a PROSPECT detector currently deployed at Oak Ridge National Laboratory's High Flux Isotope Reactor (HFIR). Antineutrinos are elementary subatomic particles with an infinitesimally small mass and no electrical charge. They are capable of passing through shielding around a nuclear reactor core, where they are produced as part of the nuclear fission process. The flux of antineutrinos produced in a nuclear reactor depends on the type of fission materials and the power level at which the reactor is operated. "Traditional nuclear reactors slowly build up plutonium 239 in their cores as a consequence of uranium 238 absorption of neutrons, shifting the fission reaction from uranium 235 to plutonium 239 during the fuel cycle. We can see that in the signature of antineutrino emission changes over time," Erickson said. "If the fuel is changed by a rogue nation attempting to divert plutonium for weapons by replacing fuel assemblies, we should be able to see that with a detector capable of measuring even small changes in the signatures." The antineutrino signature of the fuel can be as unique as a retinal scan, and how the signature changes over time can be

**Technology to measure the flow of subatomic particles known as antineutrinos from nuclear reactors could allow continuous remote monitoring designed to detect fuelling changes that might indicate the diversion of nuclear materials.**

predicted using simulations, she said. "We could then verify that what we see with the antineutrino detector matches what we would expect to see." In the research, Erickson and recent Ph.D. graduates Christopher Stewart and Abdalla Abou-Jaoude used high-fidelity computer simulations to assess the capabilities of near-field antineutrino detectors that would be located near -- but not inside -- reactor containment vessels. Among the challenges is distinguishing between particles generated by fission and those from natural background. "We would measure the energy, position and timing to determine whether a detection was an antineutrino from the reactor or something else," she said. "Antineutrinos are difficult to detect and we cannot do that directly. These particles have a very small chance of interacting with a hydrogen nucleus, so we rely on those protons to convert the antineutrinos into positrons and neutrons." Nuclear reactors now used for power generation must be refuelled on a regular basis, and that operation provides an opportunity for human inspection, but future generations of nuclear reactors may operate for as long as 30 years without refuelling. The simulation showed that sodium-cooled reactors could also be monitored using antineutrino detectors, though their signatures will be different from those of the current generation of pressurised water reactors. Among the challenges ahead is reducing the size of the antineutrino detectors to make them portable enough to fit into a vehicle that could be driven past a nuclear reactor. Researchers also want to improve the directionality of the detectors to keep them focused on emissions from the reactor core to boost their ability to detect even small changes. The detection principle is similar in concept to that of retinal scans used for identity verification. In retinal scans, an infrared beam traverses a person's retina and the blood vessels, which are distinguishable by their higher light absorption relative to other tissue. This mapping information is then extracted and compared to a retinal scan taken earlier and stored in a database. If the two match, the person's identity can be verified. Similarly, a nuclear reactor continuously emits antineutrinos that vary in flux and spectrum with the particular fuel isotopes undergoing fission. Some antineutrinos interact in a nearby detector via inverse beta decay. The signal measured by that detector is compared to a reference copy stored in a database for the relevant reactor, initial fuel and burnup; a signal that sufficiently matches the reference copy would indicate that the core inventory has not been covertly altered. However, if the antineutrino flux of a perturbed reactor is sufficiently different from what would be expected, that could indicate that a diversion has taken place. The emission rates of antineutrino particles at different energies vary with operating lifetime as reactors shift from burning uranium to plutonium. The signal from a pressurised

water reactor consists of a repeated 18-month operating cycle with a three-month refuelling interval, while signal from an ultra-long cycle fast reactor (UCFR) would represent continuous operation, excluding maintenance interruptions. Preventing the proliferation of special nuclear materials suitable for weapons is a long-term concern of researchers from many different agencies and organizations, Erickson said. "It goes all the way from mining of nuclear material to disposition of nuclear material, and at every step of that process, we have to be concerned about who's handling it and whether it might get into the wrong hands," she explained. "The picture is more complicated because we don't want to prevent the use of nuclear materials for power generation because nuclear is a big contributor to non-carbon energy." The paper shows the feasibility of the technique and should encourage the continued development of detector technologies, Erickson said. "One of the highlights of the research is a detailed analysis of assembly-level diversion that is critical to our understanding of the limitations on antineutrino detectors and the potential implications for policy that could be implemented," she said. "I think the paper will encourage people to look into future systems in more detail."

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http://www.sciencedaily.com

## Revolutionary way to bend metals could lead to stronger military vehicles

*2019-08-14*

**A United States Army project discovery upends previous notions about how metals deform and could help guide the creation of stronger, more durable materials for military vehicles.**

A United States Army project discovery upends previous notions about how metals deform and could help guide the creation of stronger, more durable materials for military vehicles. For nearly 100 years, scientists thought they understood everything there was to know about how metals bend. They were wrong. Materials science and engineering researchers at the University of Wisconsin-Madison, funded by the Army Research Office, demonstrated that the rules of metal bending aren't so hard-and-fast after all. The researchers' new mechanism for bending, published in Nature Communications, might allow engineers to strengthen a material without running the risk of fractures. The Army Research Office is an element of U.S. Army Combat Capabilities Development Command's Army Research Laboratory. "This creates new opportunities for materials design," said Izabela Szlufarska, a professor of materials science and engineering at UW-Madison. "It adds another parameter we can control to enable strength and ductility." "Professor Szlufarska has opened up an entirely new area for

exploration for structural materials processing and design," said Dr. Michael Bakas, synthesis and processing program manager at Army Research Office. "By making such a high impact discovery, Professor Szlufarska has potentially laid the technical foundation for the development of a new generation of advanced structural materials that could eventually be employed in future Army equipment and vehicles." Currently, engineers manipulate the strength of a metal through techniques such as cold working or annealing, which exert their effects through small, yet important, structural irregularities called dislocations. "Everybody in the metals community knows that dislocations are critical," Szlufarska said. It's a truism that's held since 1934, when three researchers independently realised that dislocation explained an ages-old paradox: Metals are much easier to bend than their molecular structures--which typically take the form of regularly repeating three-dimensional grids--would suggest. Dislocations are tiny irregularities in the otherwise well-ordered crystal lattice of a metal. They arise from slight mismatches--picture the pages of a book as rows of atoms, and imagine how the neat stack of paper becomes ever-so-slightly distorted at the spot where someone inserts a bookmark. Normal metals bend because dislocations are able to move, allowing a material to deform without ripping apart every single bond inside its crystal lattice at once. Strengthening techniques typically restrict the motion of dislocations. So, it was quite a shock when Szlufarska and colleagues discovered that the material samarium cobalt, known as an intermetallic, bent easily, even though its dislocations were locked in place. "It was believed that metallic materials would be intrinsically brittle if dislocation slip is rare," said Hubin Luo, University of Wisconsin-Madison staff scientist. "However, our recent study shows that an intermetallic can be deformed plastically by a significant amount even when the dislocation slip is absent." Instead, bending samarium cobalt caused narrow bands to form inside the crystal lattice, where molecules assumed a freeform "amorphous" configuration instead of the regular, grid-like structure in the rest of the metal. Those amorphous bands allowed the metal to bend. "It's almost like lubrication," Szlufarska said. "We predicted this in simulations, and we also saw the amorphous shear bands in our deformation studies and transmission electron microscopy experiments." A combination of computational simulations and experimental studies was critical to explaining the result. Next, the researchers plan to search for other materials that might also bend in this peculiar manner. Eventually, they hope to use the phenomenon to tune a material's properties for strength and flexibility. "This might change the way you look for optimisation of material properties," Szlufarska said. "We know it's different, we know it's new, and we think we can use it." "While there is a long road of further

research ahead, Professor Szlufarska's discovery certainly opens up new avenues to explore for extramural and Army researchers working in structural materials," Bakas said. "It is this type of fundamental research discovery that eventually results in the advanced materials that will protect soldiers 25 to 30 years from now."

EurekAlert, 12 August 2019

http://www.eurekalert.org

## The formula that makes bacteria float upstream

*2019-08-14*

Bacteria can swim against the current - and often this is a serious problem, for example when they spread in water pipes or in medical catheters. How they manage to do this has not been clear until now. An international research team, including Andreas Zöttl from the TU Wien (Vienna), was able to answer this question: With the help of experiments and mathematical calculations, a formula was found that describes all essential aspects of this amazing bacterial motion behaviour. This could make it possible to prevent or at least slow down the spread of bacteria by designing special tube surfaces. The results have now been published in the journal "Nature Communications".

**Until now, it has been unclear how bacteria manage to swim against the current; an international research team has now found a physical explanation**

Between Physics and Biology

Many types of bacteria, such as the E. coli bacteria, which can often become a health hazard in water, move around with the help of small flagella tails. "This is quite different from the motion of a fish," says Andreas Zöttl from the Institute for Theoretical Physics at Vienna University of Technology. "Fish feel the direction of the current and can decide to swim in a specific direction. Bacteria are much simpler. Their behaviour can be explained by very basic physical laws." Bacteria often accumulate on surfaces overflown by liquids - this can be the poorly cleaned shower cubicle, a sewage pipe or even a catheter. "The bacteria's behaviour is particularly interesting on such surfaces," says Andreas Zöttl, "because it turns out that it is precisely there, directly on the surfaces, that the bacteria often migrate against the current. They are therefore not washed away with the wastewater, but they move upstream." Together with colleagues from Stanford University, Oxford University and the ESPCI in Paris, Andreas Zöttl set out to find a physical explanation for this effect.

Theory and experiment

Andreas Zöttl used mathematical methods: He calculated how a bacterium can be aligned and rotated in a flowing liquid, how the flow interacts with the movement of the flagella and which movement possibilities result from this. "This leads to the remarkable result that there are different, clearly distinguishable types of movement, depending on the strength of the flow," explains Andreas Zöttl. In slow currents, the bacteria simply rotate in a circle, at a certain point they begin to move against the direction of flow. In even stronger currents, they oscillate back and forth on the surface, or they separate into two different groups that move in different directions. With a single mathematical formula, a whole range of bacterial movement patterns can be explained. At the same time, new technological methods have been developed in Paris to measure the movements of individual bacteria with specially controlled microscopes - and these measurements revealed exactly the same clearly distinguishable types of movement that the theoretical calculations had shown before. "This tells us that our theory is correct," says Andreas Zöttl. "What is particularly nice about this is that the results are very robust: They do not depend sensitively on any details, so our formula can be applied to many different types of bacteria". Even DNA strands floating around in the cell plasma can be described correctly with the new theory. The team hopes that the newly gained understanding of bacterial motion will enable them to find methods that prevent bacteria from moving. "In future, it might be possible to equip catheters with a specific geometric surface structure that prevents bacteria from migrating against the current," hopes Andreas Zöttl.

EurekAlert, 12 August 2019

http://www.eurekalert.org

**A research team from Aalto University has developed a novel strategy to create virus-based materials for catalysis.**

## Dyes and viruses create new composite material for photooxidation reactions

*2019-08-14*

A research team from Aalto University has developed a novel strategy to create virus-based materials for catalysis. The project, which is framed within the Horizon 2020 Marie Sklodowska-Curie actions, aims to pave the way towards the application of optically active biohybrid materials - a combination of biomolecules and synthetic moieties - in topics ranging from nanomedicine to green organic synthesis or environmental sciences. 'Our first challenge was to select the right photosensitiser,' says Eduardo Anaya, Postdoctoral Researcher at Aalto University, 'We decided to employ phthalocyanines, a synthetic derivative of hematoporphyrin (the dye responsible for the colour of blood), due to their outstanding

properties as a reactive oxygen species generator. However, the use of this kind of dyes in aqueous media presents several challenges that affect their performance. Therefore, careful design was necessary to maintain their properties`. In collaboration with Professor Tomas Torres' research group from the Universidad Autonoma de Madrid, a new phthalocyanine derivative was synthesised, resulting in a molecule with resilient properties in different ionic strength media. The design ensured the photoactivity of the dye even in an aqueous environment. 'One of the focuses of our research group lies in the design of new protein assemblies and their potential application as new materials' adds Professor Mauri Kostiainen, leader of the Biohybrid Materials group. 'Our approach is based on supramolecular interactions, such as electrostatic binding so, in this project, we decided to combine the positively charged dye with a negatively charged tobacco mosaic virus (a 300 nm long rod-like virus), resulting in a photoactive fibrous material. This approach led to highly ordered threads, which were thoroughly characterised by X-ray scattering and several microscopy techniques in the Nanomicroscopy Centre at Aalto', Kostiainen says. In addition to the structural characterisation, Anaya points out that the most crucial feature is that the dye remains active despite being immobilised in the fibres. ´We can fix the reaction site in solid support and pass the solution we want to react through it, being visible light the only "fuel" we use for it to happen. This allows us to create a continuous flow set-up that enable the scaling up of the oxidation process', he concludes. The research team designed a proof-of-concept device where immobilising the fibres within a glass capillary; an incoming flow was oxidised in several cycles. The resilience of the fibres was assessed, concluding that both their structural stability and photoactivity remain constant over time. One additional advantage is that, once the oxidation process is completed, a light pulse can disassemble the fibres, making them easy to dispose of. The reported approach represents the first step towards the use of biohybrids in continuous flow reactions, which represent an environmentally friendly approach to this type of industrial process.

EurekAlert, 12 August 2019

http://www.eurekalert.org

# Gossip



## Flies suggest different link between heart condition and seizures

*2019-08-14*

Gene mutations implicated in long QT syndrome in humans may trigger seizures because of their direct effects on certain brain neurons—independent from what they do to heart function, a new study with fruit flies shows. Most people with long QT syndrome have a mutation in a gene that causes bouts of fast, chaotic heartbeats. They also experience fainting spells and seizures. Previously the clinical approach has largely assumed that when the heart beats erratically, the brain eventually does not get enough oxygen—which in turn causes the seizures. "This gene seems to be a key factor in the physiological process that protects neurons from starting to fire uncontrollably in response to a rapid increase in temperature, which could lead to paralysis and death," says Yehuda Ben-Shahar, associate professor of biology at Washington University in St. Louis. Alexis Hill, recently a postdoctoral fellow in the Ben-Shahar laboratory, discovered this unexpected relationship as she probed the nervous system response to acute environmental stress. Heat in general causes neurons to start firing faster, so the brain is particularly sensitive to overheating. Mammals and other large animals have ways to maintain their internal temperature and protect their brains from heat. But not fruit flies. With no extra bulk in its tiny body, the only thing a fly can do to regulate temperature is to move from an uncomfortable spot to a comfortable one. Ben-Shahar had previously published work showing flies that lack a gene called sei couldn't save themselves at temperatures above 25 degrees Celsius (77 Fahrenheit). They had no ability to buffer heat stress, and started having seizures as temperatures increased. This gene sei—which other researchers who had previously discovered its role in seizure activity named—shows up in lots of places in fruit flies: in the neurons responsible for primary communication of both excitatory and inhibitory signals, in the glia cells of the nervous system that support neurons in various ways, and in the heart. As reported in PLOS Genetics, the researchers were able to show that sei protects against heat-induced hyperexcitability only when it is expressed in a few particular classes of neurons and glia. Knocking down the gene in the heart had no effect on seizure activity. "The ability of flies to resist the heat is in neurons that release neurotransmitters that make other neurons fire faster, the ones that excite neurons," Ben-Shahar says. Surprisingly, the study also uncovered a protective role for sei in glia, the other primary cell of the nervous system. Glia have traditionally been overshadowed by the importance of neurons, but in recent years they have been emerging as equally important in maintaining healthy

**Gene mutations implicated in long QT syndrome in humans may trigger seizures because of their direct effects on certain brain neurons—independent from what they do to heart function, a new study with fruit flies shows.**

brain functions. The fact that this work identifies a protective role of an ion channel in glia further supports the idea that glia have much broader physiological functions in the nervous system and how it might respond to environmental challenges, the researchers say.

Independent Effects

A look through the scientific literature reveals many references to seizure associated with long QT syndrome, which afflicts human beings with a genetic mutation to a sei-comparable gene called hERG, the researchers say. But most clinical practitioners assume that these seizures are a secondary outcome of cardiovascular disease. Ben-Shahar hopes this soon will change. "If you look at population statistics, there is a much higher incidence of seizures in long QT patients than in the general population," he says. "Because cardiovascular dysfunction can cause all kinds of problems, in the literature right now it is assumed that the seizures are secondary—that because the people have a sick heart, they end up developing seizures and other things. "It's possible, based on our data, that it's two independent effects. Because if the mutation is affecting the function of the gene in the heart, it will affect the function in the neurons. "And in flies, it's not going to kill neurons," Ben-Shahar says. "We know that we can completely eliminate this gene from the fly genome—and flies will develop normally, mostly. Yet they become extremely sensitive to environmental (conditions). It's possible that that's exactly what's happening in people—that it's completely independent."

Futurity, 12 August 2019

http://www.futurity.org

**Jan Schroers, a professor of mechanical engineering and materials science at Yale, believes that devices fashioned from a new class of biomaterials called metallic glasses could vastly improve outcomes for patients who need surgical implants.**

## Scratching the surface: Metallic glass implants

*2019-08-14*

A class of biomaterials called bulk metallic glasses could transform future implanted medical devices and other engineered objects. Artificial joints, blood-vessel stents, bone screws, and other implanted objects—crucial tools to help patients—carry risks related to the materials they're made of. Valves and stents, for example, can provoke an inflammatory reaction that leads to deadly clotting. Joint replacements may gradually loosen and require replacement. And any implant can cause infection. Such devices entail engineering trade-offs: utility versus the strengths and weaknesses of their component materials. But a class of biomaterials called bulk metallic glasses could transform that calculus for future implanted medical devices, as well as for a host of other engineered objects. Found

nowhere else in nature, these novel alloys may overcome many stubborn problems associated with today's implants. Shiny, grey, and pliable, bulk metallic glasses resemble ordinary metals but are stronger and harder than steel. They are nontoxic and resist corrosion and wear, making them well suited to dwell inside the body. They are elastic enough to change form and spring back with ease. And they are easily shaped. "Usually, metals processing is a big pain. It's kind of shocking—even 3-D printing of metals is a big pain," says materials scientist Jan Schroers, Ph.D., professor of mechanical engineering and materials science. "Metallic glasses have this ability to be formed like plastics." For example, when heated to temperatures achievable in a kitchen oven, a platinum-based bulk metallic glass softens to what Schroers describes as the consistency of refrigerated honey. "It doesn't really deform by itself under its own weight, but it's soft enough [that with modest] force you can deform it," Schroers says. In a cross-campus collaboration that has their lab personnel learning both metallurgic and wet-lab techniques, Schroers and Themis Kyriakides, Ph.D., associate professor of pathology and biomedical engineering at Yale School of Engineering and Applied Science, are exploring how bulk metallic glasses perform as biomaterials. For one thing, the materials are largely harmless to mammalian cells yet hostile to bacteria. This property might make them useful as an antibacterial coating on artificial joints, surgical instruments, or hospital doorknobs. Metallic glasses can also exert a druglike effect. When cells interact with the surfaces of implanted foreign bodies, they may go down the path of inflammation and rejection, or alternatively, toward a more desirable repair-like response. Which path the cells choose depends in part on the object's tiniest surface features—its nanotopography. These surface irregularities attract nearby proteins, which in turn influence passing cells in various ways. Kyriakides and Schroers can manipulate these cell behaviours by moulding specific patterns onto the surface of a metallic glass. "We can dial in whatever we want to create in terms of the surface—they could be nanopatterned, they could be porous," Kyriakides says. "These are [abilities] that are usually restricted to polymers, and we can do it with metals." That alone makes bulk metallic glasses "a fantastic toolbox," Schroers says. "You can design cellular responses that are desirable for a specific application." One such application could be a coronary artery stent. Many stents on the market today are impregnated with a drug that diffuses into the body over time to prevent clotting and formation of fibrous deposits. But a bulk metallic glass stent with the right nanotopography could exert a similar effect, eliminating the need for a drug. In orthopaedics, alloys made from calcium, magnesium, and phosphorus may gradually disintegrate in the body, a useful property for some types of bone hardware. Bulk metallic

glasses can also be formed as strong, light foams—picture a solidified sponge—the density of which matches that of bone. That similarity is important because conventional joint implants tend to be stiffer than bone and absorb too much impact, allowing the surrounding bone to atrophy from disuse and resulting in a loosened, malfunctioning joint. An implant made from a metallic glass foam could avert those complications. The term glass refers to a material whose atoms are arranged in an irregular non-crystalline pattern, and which reacts to heating by becoming viscous. To the eye and hand, metallic glasses look identical to ordinary metal. But familiar metal objects' atomic structure is crystalline, comprising rows of atoms bonded in a lattice. Metallic glasses are more like a liquid in which chaotically moving homogeneous atoms have been frozen in time. That homogeneity brings major advantages. Ordinary metal alloys' crystals meet one another along countless microscopic edges called grain boundaries, which are vulnerable to slippage and corrosion. By contrast, metallic glasses are amorphous, homogeneous, and uniform in all directions throughout, making it harder for corrosive processes to gain a foothold. Bulk metallic glasses are a brand-new material, according to Schroers. On our planet, at least, the co-occurrence of different metallic elements in a heated material that is abruptly cooled to form a glass has little or no precedent. (The closest analogue is volcanic glass, which consists mostly of silicon and oxygen, not metals.) Oddly enough, cells survive and thrive on the new exotic materials. They seem especially at home on alloys based on the pricy element platinum, according to Kyriakides: "Our cells have pretty expensive taste," he quips. In 2014, Schroers founded a company, Supercool Metals, based on his patented Yale-owned technique for shaping bulk metallic glasses that can be used in modified manufacturing operations typically used in plastics processing. "[We have] commercialized the ability to make very complicated shapes you can't make with any other process, in this material that's very attractive for a large range of applications," he says. The company is working with NASA to develop parts for robots and satellites, and has developed a cellphone case with built-in flexible buttons that may allow the development of waterproof phones. Supercool Metals also manufactures tiny components for high-end watches. Bulk metallic glasses are not ready for biomedical use just yet, but it might not take long before they are. In 2017, Kyriakides and Schroers built a glucose sensor from a platinum-based bulk metallic glass that is much more accurate than conventional sensors. Kyriakides estimates that such a sensor could be developed for clinical use within five years. "We're hoping that when

# Gossip



people see our results, they can get excited about using these materials," Kyriakides says. "We've barely scratched the surface."

Phys.org, 7 August 2019

Phys.org, 9 May 2019

# Curiosities



## Fracking Linked To Anxiety, Depression In Pregnant Women

*2019-08-15*

A new study finds that pregnant women living near hydraulic fracking activity in Pennsylvania are more likely to develop depression and anxiety. "These are vulnerable women who are growing another human being inside of them," said Joan A. Casey, the study's lead author and an environmental health scientist at the Columbia University Mailman School of Public Health. Casey and her colleagues conducted the study with 7,715 research volunteers; all were expectant mothers within the Geisinger Health System, which serves much of central Pennsylvania. "Basically … if we took 100 women and we expose them to the higher levels of fracking activity during pregnancy, four of them would develop anxiety or depression that otherwise would not have developed it," she said. The Independent Petroleum Association of America said in an e-mail that it takes issue with the fact the study didn't look at environmental data. "While these epidemiological studies claim to find possible connections based on limited data sets and assumptions, the reality here in Pennsylvania is that study after study of actual air and water sampling near these sites continue to show that shale development is being done in a way that's protective of public health," wrote spokesperson Nicole Jacobs. Casey pointed out that increased traffic connected to fracking can degrade local air quality, while increasing sound pollution and other commotion in a community. Part of the reason these mothers experienced adverse mental health issues, she said, could be due to concerns around environmental impacts, paired with a lack of control surrounding the changes. "Mothers have reported feeling like they can't keep their children safe," she said. "We can't say we're 100 percent sure that these women are developing anxiety or depression during pregnancy as a result of living near unconventional natural gas development in the Marcellus shale, but I don't have another explanation for what we're observing here." Casey said her team controlled for a variety of factors including age, race, whether a volunteer smoked and socioeconomic status. Even after taking these factors into account, women that were living closer to a greater number of fracking wells appeared to be at an elevated risk for developing anxiety and depression. While the study found that a woman's depression or anxiety issues did not lead her to giving birth prematurely or having a baby with low birth weight, Casey said a mother's mental health still affects her child. "There is quite a bit of evidence that women who have anxiety or depression during pregnancy are at an elevated risk of postpartum depression," she said. "We've all seen the

**A new study finds that pregnant women living near hydraulic fracking activity in Pennsylvania are more likely to develop depression and anxiety.**

literature on how postpartum depression is can be very serious and can affect both the mother the husband or father of the child as well as the child's development." The Department of Health and Human Services says paediatric developmental issues related to maternal post-partum can include speech delays, behavioural and social problems, problems with mother-child bonding, shorter height, risk of obesity, and a child feeling agitated or crying more.

WESA FM, 2 August 2019

https://www.wesa.fm

## Folic acid seems to be essential for fathers-to-be as well as mothers

*2019-08-15*

Prenatal vitamins like folic acid are par for the course for many women who are thinking about becoming pregnant. But growing evidence suggests that folate may be important for healthy sperm, too. Is it time to offer supplements to men? Folic acid is a synthetic version of the vitamin folate, which is known to play an important role in the healthy division of cells. Women who don't get enough folate in the early stages of pregnancy are more likely to have babies with birth defects of the brain and spinal cord. Because of this, women who are planning to get pregnant or are in the early stages of pregnancy are routinely advised to take folic acid supplements in places like the UK. In the US and Canada, folic acid has been added to foods like bread and cereal on a mandatory basis since the 1990s.

**Growing evidence suggests that folate may be important for healthy sperm, too.**

Folate for fathers

But mounting evidence suggests folate might be important for fathers-to-be, too. Research in mice and rats has shown that the amount of folate a male ingests before conception influences the pregnancy outcomes of the female mouse and the health of the offspring. To look for effects in people, Nerea Martín-Calvo at the University of Navarra in Spain and her colleagues looked at the pregnancy outcomes of 108 heterosexual couples undergoing fertility treatment at a hospital clinic in Boston in the US. All of the study participants were asked to fill out a detailed food questionnaire, so that the team could estimate how much dietary folate each person was getting. The team assessed the outcomes of the 113 resulting pregnancies and births. After accounting for factors such as age, BMI and the mother's folate intake, the group found that men who had more folate in their diets

had babies with a longer gestational period, which is generally thought to be beneficial to health, up to a point. An increase in folate intake in men of 400 micrograms per day – the amount recommended to mothers-to-be by the World Health Organization – was associated with a 2.6-day longer gestation period.

Too much or too little

The study is small, but supports other research findings. When a team at the Erasmus University Medical Centre in Rotterdam in the Netherlands assessed 511 pregnancies, they found that the level of folate in a man's blood correlated with the size of his baby. Too much or too little folate was linked to smaller babies, so there appears to be an optimum level, say the authors of the work, who published the study in February. This is probably thanks to the role that folate plays in sperm cells in establishing the epigenome, a layer of markers that influence which genes are switched on or off. These epigenetic changes have recently been found to carry through multiple generations. It is too soon to recommend folic acid supplements to men who are planning to start a family, says Sarah Kimmins at McGill University in Montreal, Canada. "We know folate is important for cell division, and men make a million sperm with every heartbeat […] but we don't know what the right amount is for men for optimal fertility and the optimal sperm epigenome," says Kimmins, who researches environmental impacts on men's fertility and the health of their offspring.

Supplements for men?

Folic acid supplements might be useful in a country where the vitamin isn't routinely added to food but might be overkill in places like the US and Canada, if men are already getting enough in their diets, for example. "That is something that policy makers need to focus on and is why studies like this are very important," says Kimmins. It isn't just folate: other aspects of a man's diet and lifestyle can also affect his fertility and the health of an embryo. Most of the men who volunteered for Kimmins's research in Canada have been found to have a vitamin D deficiency, for example, which seems to be linked to low sperm motility. "Men who are smoking, exposed to drugs or second-hand smoke or are obese, for example, will have epigenetic changes to their sperm that can be passed on," says Ranjith Ramasamy at the University of Miami. "Folate is just the tip of the iceberg." Boys need to learn that their lifestyle can affect their fertility for the rest of their lives, says Kimmins. "Men aren't getting those messages –

they often think they are not part of the equation," she says. Health advice for parents-to-be need to target men too, not just women, she says.

New Scientist, 2 August 2019

http://www.newscientist.com/

## Humans are good at smelling cheese thanks to special smell receptors

*2019-08-15*

Smell that? If it's cheesy, sweaty or sweet, you might be more likely to sense an odour. Humans have evolved many more smell receptors for these scents than anything else, probably to help us choose which foods to eat. Luis Saraiva at Sidra Medicine in Doha, Qatar, and his colleagues looked at smell receptors in mice and people. They started by analysing the small patch of neurons that contain smell receptors. This area is about 2.5 square centimetres in humans, and sits in between the eyes at the top of the nasal cavity. To find out which smell receptors mice and people have, the team extracted mRNA from each of the samples. This molecule plays a key role in allowing genes to make proteins, so the team used mRNA levels to tell them which genes in each sample were "switched on", as well as their relative abundance. Both species have more receptors for odours that smell like rancid milk or cheese, sulphur or sweat, or are particularly sweet or spicy-smelling, like vanilla or clove than for other smells. This may mean that we are more sensitive to these scents, although we can't say for sure yet. In humans, these smells are important for helping us make decisions about which foods to eat, and for distinguishing between what's ripe and what's rotten, says Saraiva. But in mice, the chemicals act as pheromones – chemicals that can change their behaviour, such as those that attract mates. Some of the chemicals that humans have lots of smell receptors for are also found in bodily fluids like breastmilk and vaginal fluid. These act as pheromones in other primates, but there is no evidence that they do in humans, says Saraiva.

New Scientist, 31 July 2019

http://www.newscientist.com/

# Curiosities



## Physicists Overturn a 100-Year-Old Assumption on How Brain Cells Work

*2019-08-15*

The human brain contains a little over 80-odd billion neurons, each joining with other cells to create trillions of connections called synapses. The numbers are mind-boggling, but the way each individual nerve cell contributes to the brain's functions is still an area of contention. In fact, a study published in 2017 has overturned a 100-year-old assumption on what exactly makes a neuron 'fire', posing new mechanisms behind certain neurological disorders. A team of physicists from Bar-Ilan University in Israel conducted experiments on rat neurons grown in a culture to determine exactly how a neuron responds to the signals it receives from other cells. To understand why this is important, we need to go back to 1907 when a French neuroscientist named Louis Lapicque proposed a model to describe how the voltage of a nerve cell's membrane increases as a current is applied. Once reaching a certain threshold, the neuron reacts with a spike of activity, after which the membrane's voltage resets. What this means is a neuron won't send a message unless it collects a strong enough signal. Lapique's equations weren't the last word on the matter, not by far. But the basic principle of his integrate-and-fire model has remained relatively unchallenged in subsequent descriptions, today forming the foundation of most neuronal computational schemes.

**The human brain contains a little over 80-odd billion neurons, each joining with other cells to create trillions of connections called synapses.**

According to the researchers, the lengthy history of the idea has meant few have bothered to question whether it's accurate. "We reached this conclusion using a new experimental setup, but in principle these results could have been discovered using technology that has existed since the 1980s," said lead researcher Ido Kanter at the time. "The belief that has been rooted in the scientific world for 100 years resulted in this delay of several decades." The experiments approached the question from two angles – one exploring the nature of the activity spike based on exactly where the current was applied to a neuron, the other looking at the effect multiple inputs had on a nerve's firing. Their results suggest the direction of a received signal can make all the difference in how a neuron responds. A weak signal from the left arriving with a weak signal from the right won't combine to build a voltage that kicks off a spike of activity. But a single strong signal from a particular direction can result in a message. This potentially new way of describing what's known as spatial summation could lead to a novel method of categorising neurons, one that sorts them based on how they compute incoming signals or how fine their resolution is, based on a particular direction. Better yet, it could

even lead to discoveries that explain certain neurological disorders. It's important not to throw out a century of wisdom on the topic on the back of a single study. The researchers also admit they've only looked at a type of nerve cell called pyramidal neurons, leaving plenty of room for future experiments. But fine-tuning our understanding of how individual units combine to produce complex behaviours could spread into other areas of research. With neural networks inspiring future computational technology, identifying any new talents in brain cells could have some rather interesting applications. This research was published in Scientific Reports.

Science Alert, 2 August 2019

http://www.sciencealert.com.au

## Gut throws cells overboard when chemical insults build up

*2019-08-15*

A team of Duke researchers has discovered that cells lining the gut of zebrafish—and probably humans too—have a remarkable defence mechanism when faced with certain kinds of toxins: they hit the eject button. "The gut has the challenging job of handling all the chemicals that we consume or produce, and some of those chemicals can be damaging. So, the gut has evolved many interesting ways to defend against damage," said Ted Espenschied, a Duke graduate student who led the effort as part of his dissertation research. The Duke team was testing more than 20 non-steroidal anti-inflammatory drugs (NSAID) in an attempt to make the zebrafish a new model for studying chemical injury in the gut. The fish are cheap to maintain, easy to breed, and most importantly, translucent for the early part of their lives, Rawls said. It's also easy to administer chemical exposures and measure their environmental conditions via the tank water. The researchers found something unexpected. "It's often the case that drugs have multiple off-target effects," said John Rawls, an associate professor of molecular genetics and microbiology and director of the Duke Microbiome Centre. But only one of the drugs they tested seemed to create any measurable differences in the fish, an old NSAID called Glafenine. It had been an over-the-counter oral painkiller used in Europe and the Middle East for three decades, but was taken off the market after being linked to kidney and liver damage. Glafenine was making the fish shed up to a quarter of the cells lining their intestines overnight by a process called delamination. What hadn't been recognised before is that delamination, which seems catastrophic, is actually a highly effective defence strategy.

**A team of Duke researchers has discovered that cells lining the gut of zebrafish—and probably humans too—have a remarkable defence mechanism when faced with certain kinds of toxins: they hit the eject button.**

# Curiosities



The lining of the gut is a single layer of finger-like epithelial cells packed closely together. When a gut epithelial cell is distressed, it somehow becomes marked for destruction. During delamination, neighbouring epithelial cells push against the doomed cell to loosen its anchor to the basement membrane they all stand on. The neighbours squeeze in on it and crowd it out until it pops up and is carried away to die in the gut. "We weren't expecting delamination to be protective," Espenschied said. Espenschied pivoted on the unexpected finding. "Only one NSAID had this remarkable effect of causing delamination of the gut epithelium and we were wracking our brains trying to figure it out," Espenschied said. "So, we chased it," Rawls added. After many experiments and a detailed analysis of Glafenine's chemical properties, Espenscheid determined that it wasn't the drug's NSAID qualities that harmed the gut, but rather its ability, apparently unique among NSAIDs, to inhibit a cellular structure known as the multidrug-resistant, or MDR, efflux pump. These pumps exist to help purge unwelcome chemicals from the interior of the cell. Cancer researchers have been very interested in finding ways to block MDR efflux pumps because tumours ramp them up dramatically to push chemotherapies out of cancer cells, foiling cancer therapy. Much less is known about what the pumps do in normal cells. "We do know that if you block these pumps, cells are unable to clear toxic chemicals and problems ensue," Rawls said. When Glafenine blocks the MDR efflux pumps in zebrafish, the gut responds with delamination, by means the researchers haven't yet identified. "We don't know yet which cells leave and why," Espenschied said. "What separates that cell from its neighbours is a really fascinating question that we don't know the answer to yet." "Delamination is a common solution to a lot of different insults," Rawls said. "But it's been challenging to understand if that is contributing to damage and disease, or a beneficial adaptation to the insult. Our work shows that it's actually beneficial."

Medical Xpress, 5 August 2019

http://medicalxpress.com

## Health Officials Blame Vaping for "Severe Respiratory Illnesses"

*2019-08-15*

That's been a well-accepted medical fact for decades now — smoking kills, right? — but the debate over the merits and dangers of vaping somehow continue on. But now 14 teens and young adults in Wisconsin have been hospitalised for vaping-related breathing problems, according

to CNN. It's troubling news for e-cigarettes, which are usually painted in a more positive light due to meme-able vape clouds and questionable claims that they helping people quit smoking. The health departments of Wisconsin and Illinois announced recently that the group of teens and young adults were hospitalised for severe lung disease and breathing problems due to their vaping habits. The Wisconsin Department of Health Services reported 11 cases over the last month, per CNN, with three more involving young folks with "severe breathing problems." The cases stand out because doctors determined that none of the vaping teens had pre-existing health problems — meaning that vaping seemingly caused their lung woes. The 11 patients in Wisconsin were "otherwise normally healthy, and they were coming in with severe respiratory illnesses, and in some cases, they actually had to go to the intensive care unit and were placed on ventilators," Wisconsin Health Department respiratory disease epidemiologist Thomas Haupt told CNN. Haupt said he and his team initially thought people were coming in with lung infections, but they eventually ruled out every possible cause except for vaping. "The only thing at this point is vaping," Haupt told CNN, "but we don't know what they vaped, where they got their vaping liquids, all this needs to be determined at this point." Back in October, the headquarters of the popular e-cigarette brand Juul got a not-so-friendly visit from the FDA. The company has repeatedly come under fire for marketing its vapes to teens and inadvertently getting a new generation addicted to nicotine. Now the company has launched a new age-verification app, Engadget reports, which uses facial recognition and background checks to keep vapes out of underage hands. The fourteen hospitalisations haven't been directly linked to Juul — CNN reports that the state health departments are still investigating to find out what everyone was smoking and what they were using to do it. But in spite of new tools and tricks to enforce age restrictions, the doctors expected the problem to get worse before it gets better.

Futurism, 5 August 2019

https://futurism.com

**Airport officials say they're doing everything the law requires regarding PFAS. Experts say the law doesn't go far enough.**

## PFAS contamination is likely at Pittsburgh airport. Airports may face legal challenges by doing nothing.

*2019-08-15*

Reports from former firefighters, airport records, expert scientists and a military study indicate that the Pittsburgh International Airport is likely the source of a PFAS chemical plume. Airport officials say they are

doing everything the law requires but declined to say if they are taking additional steps experts say are needed to protect the health of nearby residents. If the Allegheny County Airport Authority doesn't investigate the possibility of PFAS contamination released through firefighting foam, some lawyers say it could find itself in legal jeopardy. Airports are not required by law to investigate PFAS contamination. Still, there are more than 75 lawsuits across the country against entities that have discharged the foam containing PFAS, and the number is growing. Some airport industry officials hope that, because the Federal Aviation Administration [FAA] requires airports to use firefighting foam that contains PFAS, the airports won't be held liable for letting it contaminate their properties. Not every lawyer thinks this argument will hold up, and a lobbying group for the airport industry is pushing Congress to pass a law that will limit their financial exposure. As the legal questions get sorted out, airports across the country are deciding whether and how to respond to the potential health consequences for residents who live nearby. Interviews with five former firefighters at the Pittsburgh International Airport and airport records indicate that potentially high volumes of toxic chemicals from the foam may have entered the ground and groundwater at the airport. This contamination could have been flushed into local streams and carried into surrounding neighbourhoods, contaminating the drinking water in nearby private water wells. The closest public drinking water source is Moon Township, which uses carbon filtration that removes PFAS and tested below the federal health advisory for PFAS in December. Since the early 1970s, airport firefighters have been using aqueous film forming foam [AFFF] to put out and prevent oil and gas fires, which are potentially more dangerous at airports. Although the firefighters say they didn't use the foam on many actual fires, the foam was used extensively during equipment testing, fire trainings, fuel spills and accidental discharges. "Just about every drop of foam that they ever bought went onto the ground, into the soil, into the waterways of the state," said Bob Scharding, who worked as a firefighter at the airport from 1987 to 2007. The foam contains PFAS, a toxic class of chemicals associated with cancers, kidney disease, low infant birth weights and hormone disruptions. PFAS contamination is typically measured in "parts per trillion" because of how toxic it can be even in miniscule quantities. Records show the airport purchased 4,950 gallons of AFFF concentrate from 2012 to 2018. PublicSource does not have records for how much the airport purchased before 2012. The airport currently uses a brand of AFFF called Chemguard, which may be less harmful than the kind previously used and was known to contain toxic PFAS. Airport officials didn't respond to questions about when it switched foams. Although companies like DuPont, a spinoff company

called Chemours and 3M have known for decades about the threat of PFAS chemicals, public awareness has grown recently and the Environmental Protection Agency [EPA] set its first health advisory for the chemicals in 2009.

Gov. Tom Wolf convened a task force last September to address the problem of PFAS contamination in Pennsylvania. The task force is surveying about 300 water sources in the state to identify how widespread the contamination is. Two contamination sites have already been identified in Southwestern Pennsylvania, both of which are military bases that lease their land from Pittsburgh's airport. The bases began looking for PFAS contamination in 2015 as part of a national effort to survey the extent of the military's PFAS contamination from firefighting foam and found PFAS in the soil and groundwater exceeding standards at 24 of 31 sites tested. In one spot, the sample was 87 times higher than the EPA's federal threshold for safe drinking water. The five firefighters, who worked at the airport between 1972 and 2010, said they believe they used a lot more toxic firefighting foam than was used at the military bases. The military bases had only nominal firefighting roles, they said. "Really, we provided fire protection for both [of] the bases," Scharding said. "I never even saw their guys in any kind of gear." One of the main properties of PFAS chemicals is that they do not break down on their own. Many of the chemicals that were left in the ground decades ago are likely still there. The rest would have been carried away by rain into pockets of underground water and nearby streams. Contaminated drinking water, one of the most common ways humans ingest PFAS, has to either be taken offline or passed through an expensive filter. At a single firehouse in Rhode Island, environmental officials suspect that a spill of as little as 5 gallons of AFFF up to 17 years ago led to the contamination of well water that served more than 30 homes. The contamination was discovered in 2017 through state testing; the affected residents were given bottled water and are now being connected to the public water supply at a cost of $3 million. The former Pittsburgh airport firefighters said the contamination may not be contained to only airport property and its surroundings. They described times when AFFF was used on a large restaurant fire on the North Side, along highways in the South Hills and during fire trainings at a North Park facility run by Allegheny County Emergency Services. The Allegheny County Airport Authority declined at least nine interview requests by email, phone and in person between November and July and didn't respond to more than 50 written questions that were emailed on June 7. The authority declined a final request to speak about PFAS contamination on Aug. 8. In December, PublicSource requested records of any tests,

environmental assessments or reports about PFAS contamination through Pennsylvania's Right-to-Know Law. The airport didn't provide any. Emails between officials discussing PFAS, results of AFFF equipment testing and descriptions of procedures were provided. "We've done everything that we're required to do, and we'll continue to do everything that we're required to do," said Christina Cassotis, the chief executive officer of the airport authority, after being asked by a PublicSource reporter about the airport's PFAS response at a June board meeting. Cassotis said the airport is following all FAA regulations. The PFAS concern "raises some complex legal questions" because the FAA requires the airport to use AFFF, said Justin Barkowski, vice president of regulatory affairs at the American Association of Airport Executives. Some airports are not preparing for how to deal with potential contamination as quickly as others, according to Barkowski. He said "most" airports have already begun PFAS testing even though it is not a requirement yet. "We haven't talked with every single airport, but we know that's generally where airports are at," Barkowski said. Airport records, internal emails and government-sponsored surveys sent to and among Allegheny County Airport Authority officials indicate the authority has known about the potential risk for years. Attention to PFAS contamination has ratcheted up in the last year since the governor launched the task force, and there has been media coverage about contamination state-wide. Mark Cuker, a Philadelphia lawyer experienced in PFAS cases, said the authority could face legal liability even if it's doing everything required by law. "That's absolutely not a defence," Cuker said. "There's plenty of law that says that a party can be found to be negligent even when they follow the letter of the law. The standard is 'reasonable care.' Is it reasonable to do nothing when you know there might be a problem? I don't think so." "Although each factual situation is different, due to the persistent nature of these chemicals in the environment, sticking one's head in the sand and hoping these PFAS compounds will degrade over time is probably not an effective strategy," Steve Siros, a New York lawyer, recently wrote in a Law360 expert analysis. Once an airport investigates PFAS contamination, it would likely be required to report it to state environmental agencies under "reportable discharge laws" and would then be required to begin remediation relatively soon, according to Marty Judge, an environmental lawyer in New Jersey. There may be a downside to not waiting to address PFAS contamination, he said: remediation technology could get better and cheaper, and state and federal standards could become more stringent, meaning entities may have to duplicate the work. In some cases, Judge added, an airport may need to be sued or directed to take action by the government for its

insurance to pay out. "A purely voluntary PFAS remediation might not be enough to trigger coverage," he wrote.

The cost of conducting a comprehensive evaluation of an airport's PFAS contamination depends a lot on the airport, according to Zachary Puchacz, an airport planner in Michigan. The state of Pennsylvania is currently spending $250,000 to test more than 300 water sources across the state. But Puchacz said the cost to each airport depends on factors like the "size of airport, volume of material used, number of areas designated for testing, depth of soil/water test borings needed." Although the airport authority says it is following all laws and regulations, there is evidence that its officials know that other airports are doing more to protect the public. PublicSource learned through a Right-to-Know request that Cassotis received emails from the American Association of Airport Executives in 2018 that included discussion from airports in several other states discussing a switch to a less toxic form of firefighting foam and about how to create better containment areas to prevent AFFF from contaminating the environment. Keith Leonhardt, the airport operations manager for the Massachusetts Port Authority, asked in one of those emails about "the steps you take to ensure the AFFF is appropriately contained to prevent releases into the environment," he wrote. "We here ... set up a containment area, use a defoaming agent on the dispensed foam and then suck it all up for environmental disposal. It's time consuming and costly." The Allegheny County Airport Authority did not respond to questions about whether Cassotis read these emails. Barkowski said the issue of PFAS contamination has been a topic at meetings of the American Association of Airport Executives for at least the past few years. In December, the state Department of Transportation sent a questionnaire directly to Cassotis, requesting information about the airport's use of AFFF. The survey included an attachment that described the potential health risks, "particularly if the foam solutions reach drinking water sources, groundwater, or surface waters." PublicSource requested to see the airport's response, and the authority asked for a 30-day extension to reply. The attached document also states the airport could be legally responsible for dealing with its AFFF pollution. "Currently, federal law does not prohibit the use of legacy AFFF remaining in existing stocks…" the report states. "However, any discharge to a stormwater system, including AFFF... could be considered a pollutant and is regulated by the Clean Water Act." The attachment sent to Cassotis listed a number of best practices for airports, including: "Avoid direct release to the environment to the greatest extent possible." "Collect, treat, and properly dispose of runoff/wastewater from training events or live fire events to the greatest extent possible."

# Curiosities



"Make note of sensitive receptors (for example, streams, lakes, homes, areas served by wells) identified in the vicinity of foam use and report to environmental agencies as required." None of these best practices were implemented by the firefighters who spoke to PublicSource during their times at the airport (1972-2010), they said. The airport did not respond to specific questions about its current or past practices. Between December 2015 and February 2016, a representative for the Allegheny County Airport Authority responded to a survey for a study by the National Academies of Sciences [NAS]. The study, sponsored by the FAA, inventoried the typical practices at airports for dealing with AFFF. The report showed that about one in four airports in the same class size as Pittsburgh had conducted an environmental site investigation into potential PFAS contamination. In the past four years, more airports have followed suit. For example, in March 2018, a news report indicated that there may be PFAS contamination at Gerald Ford International Airport in Grand Rapids, Michigan, which serves about a third as many passengers as Pittsburgh. A month later, the airport had installed five wells for testing groundwater and began testing soil and surface water. A few months after that, the airport offered to test the drinking water wells of 44 nearby property owners. The airport is continuing work to protect nearby residents to this day. PublicSource released an article in November 2018, indicating that PFAS contamination was confirmed at military bases immediately adjacent to Pittsburgh's airport. In May, PublicSource published an article describing the extent of the contamination, including the fact that the military believed the contamination could have extended beyond its borders. And in June and July, PublicSource posed questions to the airport authority about potential contamination and informed officials that five of its former firefighters indicated there is likely a problem. It's standard procedure to interview firefighters when assessing potential PFAS contamination, a step the military took at the start of its PFAS testing near the airport in 2015. The airport replied by questioning the quality of PublicSource's reporting. "Is the story going to identify the people making these claims and in what timeframe they are referencing or is this going to be anonymous sources with vague details?" asked Bob Kerlik, the airport authority's director of media relations. (Interviews with Scharding and the four other former firefighters are all on the record, and details of their accounts are further explored in this accompanying story.) Kerlik wrote in a May email to PublicSource that the authority now uses a safe firefighting foam and has implemented procedures that minimize the chances the foam could contaminate the environment. He did not elaborate on past practices or say when the foam change was made. Other airports across the country are dealing with PFAS contamination from AFFF more proactively. PFAS

was found at five airports in Alaska, including in the drinking water at two of them, and the state is providing drinking water alternatives when it is responsible. California is testing for PFAS at 31 airports, in addition to local water supplies, a step that Pennsylvania has not taken. And the Barnstable Municipal Airport on Cape Cod held public meetings in July about its PFAS contamination. Ann Richart, who left her position as the director of Martha's Vineyard Airport in May for a new position in Nebraska, gave a public presentation in March about launching an investigation into PFAS contamination there in February 2018. In October 2018, the airport began testing the drinking water of nearby residents. Fourteen homes tested positive for PFAS above the level the EPA considers safe. Richart said the FAA told her that spending airport revenue on PFAS testing off of airport property was an "appropriate" use of airport revenue. The Martha's Vineyard Airport Commission went out on a limb, Richart said, because typically the FAA provides 90 percent of an airport's improvement funding but it isn't doing that with PFAS remediation. "Airports are starting to understand they are in a real bind between trying to professionally manage their airport and budget and also doing the right thing," she told PublicSource. The president of the American Association of Airport Executives told House Speaker Nancy Pelosi in July that PFAS legislation being considered could lead to "extensive and costly litigation and clean-up efforts at airports across the country that are required by federal regulation to use firefighting foam that contains PFAS and have no alternatives to the use of such foam." The airport executives have been lobbying for airports to be exempt from Superfund legislation that could make them vulnerable to lawsuits.

Most airport firefighting units, including at Pittsburgh's airport, are now using an AFFF made from a shorter PFAS chemical. Some health experts think these chemicals may be safer because they wash out of the body more quickly than the chemicals in the AFFF before 2002. But it's not totally clear how safe these new PFAS chemicals are. Carla Ng, a scientist who studies PFAS chemicals at the University of Pittsburgh, said the smaller size of the new PFAS chemicals makes them harder to remove from drinking water. And, Ng said, even if the shorter chains of PFAS are flushed from the body more quickly, the more we emit into the environment, the higher the concentration that can build up in our bodies. "So, we'll still reach some steady state concentration because we're continuously being exposed," she said. For the time being, the FAA still requires airport firefighters to carry and test AFFF, although new legislation will end that requirement in 2021. The FAA and EPA did not respond to emails for comment. Congress is currently looking into new

rules for PFAS, which could turn PFAS contamination sites into Superfund sites and provide additional funding for clean-up. Some states, like New Jersey, Michigan and Vermont, have already implemented more stringent rules for PFAS contamination that require entities like airports to take more protective action. Pittsburgh International Airport is undergoing a $1.1 billion upgrade to the terminal to be completed by 2023. A NAS report states that an airport's long-term finances could be at risk because of PFAS particularly because future construction projects would have to take into account the potential impact of PFAS remediation. The "legacy impacts have the potential to significantly affect capital improvement projects should impacts of PFASs be encountered." Cuker, the lawyer who works on PFAS cases, said the airport authority is also at risk of being sued by anyone near the airport who drinks contaminated water and develops a disease associated with PFAS contamination. Private water well owners are particularly vulnerable. "You can't taste this, you can't smell it but it can kill you and certainly make you sick," Cuker said. "People should not be drinking it if it's above [the contamination] level." "Frankly it's outrageous" that nearby residents haven't had their water wells tested, he added. The Department of Defence has acknowledged that there are at least five water wells within a mile of the two military bases that could be contaminated. But there have been no plans for tests so far. A state database of well sites indicates other residents and businesses with water wells near the airport could also be at risk. And the risk extends to other communities where firefighters may have used AFFF outside of the airport's property lines. The state Department of Environmental Protection [DEP] is testing more than 300 large water supplies this year but does not currently have a plan to test private wells. The airport didn't respond to questions about whether they were concerned about the potential health impact to nearby residents. "Listen, we're doing everything that's required by DEP and the EPA and everything that's required by the FAA," Cassotis, the airport authority CEO, said in June. "We follow all the rules. We follow all of the rules."

Environmental Health News, 12 August 2019

http://www.environmentalhealthnews.org/

## Industry Cites 3M Experiment That Exposed Cancer Patients To PFAS To Claim The Chemicals Aren't So Bad

*2019-08-15*

Defenders of the chemicals known as PFAS have seized upon an industry-funded study of cancer patients as evidence that the compounds used

**Defenders of the chemicals known as PFAS have seized upon an industry-funded study of cancer patients as evidence that the compounds used to make Teflon, firefighting foam, and many other products aren't as dangerous as they seem.**

to make Teflon, firefighting foam, and many other products aren't as dangerous as they seem. The study, which was funded by the Minnesota-based global conglomerate 3M and published in February 2018 in the journal Toxicological Sciences, exposed 49 terminal cancer patients to high doses of PFOA. Now recognised as a widespread water contaminant, PFOA was originally developed by 3M. The authors of the study, who include a 3M staff scientist and two University of Minnesota faculty members who received research grants from the company, initially describe its purpose as assessing the chemotherapeutic potential of PFOA. Yet the paper contains little mention of how the chemical affected patients' cancers and instead focuses on their cholesterol levels, which appeared to decrease slightly over a six-week trial period. (Since the study's publication, one of its authors, Matteo Convertino, left the institution.) The authors suggest that their finding upends the observation made in many other studies that environmental exposure to PFOA increases cholesterol levels and may motivate "re-examination of the implications of population studies exposed to much lower levels of PFOA," as they write in the abstract. Indeed, the clinical trial is at odds with the extensive scientific literature on the chemicals based on populations of people who had been exposed to PFAS for years. That research shows that very low levels of the chemicals, which accumulate in the body over time, cause elevated cholesterol levels and interfere with developmental, hormonal, reproductive, and immune function. Among the health problems associated with the chemicals are reduced penis size, thyroid disease, and cancers. Although PFOA does not appear to have helped combat the cancers in any way and, according to a note in the text, left some patients unable to complete the regimen due to fatigue, nausea, vomiting, and diarrhoea, the industry has promoted the research as a win. "Good News on PFOA" was the heading of a 2010 email about early results from the clinical trial that Mike Neal, a member of the trade organisation PlasticsEurope, sent to his colleagues. The email forwarded results from the study sent to him by a DuPont scientist. Lawyers for DuPont tried to introduce early results from the research as evidence in a 2015 trial filed on behalf of a woman who developed kidney cancer after drinking PFOA-contaminated water. The judge disallowed the attorneys from mentioning the study, and the company was ultimately found liable in the case. As pressure mounts for states and the federal government to set regulatory levels for PFAS, industry groups that face liability over water contamination have turned back to the small study as evidence that the scientific approaches previously used to calculate safe exposures levels "are not predictive of humans and result in unreasonably conservative values," as the American Petroleum Institute wrote in comments it submitted to the Environmental Protection Agency on June

10. (Among the many industrial uses of PFAS are oil and gas extraction and mining.) The industry has promoted the research as a win. The U.S. Chamber of Commerce, the American Forest & Paper Association, and the American Fuel & Petrochemical Manufacturers also embraced the 3M paper's findings. In a June letter to the EPA commenting on the agency's proposed recommendations for addressing PFAS contamination, the groups referred to the study as "very important for predicting appropriate risk-based drinking water values." A letter from the American Chemistry Council about the same proposed regulations also cited the research. While industry representatives have also called on state regulators to consider the study as they weigh safety levels for PFAS, some have rejected the suggestion. New Jersey's Drinking Water Quality Institute responded with scepticism to a 2014 request from the Chemistry Council of New Jersey to consider the then-unpublished research on the cancer patients, which was submitted to the agency as an abstract. While the industry group argued that the experiment showed that patients' liver and kidney function wasn't affected by PFOA, state regulators pointed out that the abstract referred to a patient who "experienced drug related toxicity (DLT) consisting of 'grade 5 renal failure.'" It is unclear why that patient isn't mentioned in the published paper.

In an email with some grammatical errors and a misspelling, Matteo Convertino, the study's first author, wrote that a company, CXR Biosciences, conducted the original research on the cancer patients and that he and his co-authors used their data to produce the paper. "As far as we know, the study was conducted under Ethics Committed review at all the clinic sites and subjects gave written informed consent," he wrote. "3M, that funded our study, was only interested in the assessment of PFOA effects on recorded physiological indicators." Asked what basis they had for believing that PFOA might be of chemotherapeutic value, Convertino wrote on behalf of himself and one of his co-authors, Timothy Church, "Neither of us is expert in chemotherapy and cannot vouch for the rationale CXR gave for the anti-neoplastic potential of PFOA." The New Hampshire Department of Environmental Services cast doubt on the study, noting in a June document responding to public comments on the state's proposed safety standard for PFAS that "NHDES has serious reservations about relying on the results of such a study with a small sample size, restrictive inclusion criteria for participants, and the use of late-stage cancer patients whose metabolic function is not likely comparable to the general population." A medical ethicist also expressed serious reservations about the study. "The paper raises lots of ethical questions," said Robert Klitzman, a professor and academic director of the master's program in

bioethics at Columbia University. Klitzman noted that the authors did not present their cholesterol findings in "clinically meaningful terms" and raised questions about what the terminally ill patients were told when asked to participate in the study. Alan Ducatman, a physician who has extensive experience researching the health effects of PFOA, pointed out that neither the dose used in the study nor its duration reflect typical environmental exposures to the chemical. Ducatman also took issue with the study's size. "These guys are saying their 49 dying cancer patients are better than the hundreds of thousands of people that have already been studied," he said. "It makes no sense." Nevertheless, Ducatman can expect to hear more about the experiment in the coming days. He is among 400 people attending a national meeting of the Society of Environmental Toxicology and Chemistry focusing on PFAS this week. The toxicologist Michael Dourson, who helped plan the meeting, is publishing a paper that uses the cancer patient research to question human sensitivity to PFOA and will display this work at the meeting, according to an email he sent to colleagues. Sponsors of the meeting include 3M; the global industry trade group FluoroCouncil, representing companies that make PFAS; and the environmental research programs of the Department of Defence — all entities that have huge financial stakes in the regulation of PFAS. This isn't the first time that Dourson has weighed in on how to calculate safety levels for PFOA. In 2000, the toxicologist was recommended by DuPont executives to help West Virginia set a regulatory level for the chemical. Dourson's consulting company, Toxicology Excellence for Risk Assessment, had "a very good reputation among the folks that are still in the business of blessing criteria," one executive explained, going on to praise TERA's ability to "assemble a package and then sell this to EPA, or whomever we desired." Dourson's company got the job and, in 2002, helped West Virginia set a regulatory level that was 150 times higher than an internal safety level set by DuPont. (Dourson, whom Trump nominated in 2017 to run the EPA's chemicals program, was not confirmed for that job in part because of concerns about his record on PFAS.) Nor is the cancer patient study the first to raise the idea that PFOA, a known cause of disease and environmental contamination, might provide health benefits. Industry consultants known as the Weinberg Group sent a now-notorious memo to DuPont in 2003 recommending that the company "reshape the debate by identifying the likely known health benefits of PFOA exposure." (DuPont has denied that it hired the consulting firm. But, as The Intercept reported in 2015, the Weinberg Group invoiced DuPont for work several months after the memo was sent.) The Weinberg Group laid out a strategy for halting mounting investigations into the dangers of PFOA, "which discourages governmental agencies, the plaintiff's bar, and misguided

environmental groups from pursuing this matter any further." Among the group's suggestions was "constructing a study to establish not only that PFOA is safe over a range of serum concentration levels, but that it offers real health benefits."

The Intercept, 13 August 2019

https://theintercept.com

## Exposure to dispersant raised likelihood of neurological symptoms in Deepwater Horizon responders: study

*2019-08-15*

United States Coast Guard members who were exposed to oil while responding to the Deepwater Horizon catastrophe were twice as likely to experience headaches and dizziness as those who were not, according to a new study by researchers with the Uniformed Services University, a health science university in Maryland that is run by the federal government. And those who were exposed to dispersants as well as oil were significantly more likely to report acute neurological symptoms than those who were exposed only to the oil, said Jennifer Rusiecki, one of the study's authors and a professor in the university's department of preventive medicine and biostatistics. Previous studies have examined lung and skin irritation in relationship to exposure to oil and dispersants. But the new study provides a glimpse of acute neurological effects stemming from exposure to the oil and dispersants. The study will be published in the journal Environment International in October, but is available online now. In addition to local fishers and coastal residents, more than 8,500 U.S. Coast Guard personnel were deployed to help aid in the clean-up after the 2010 Deepwater Horizon explosion led to the largest marine oil spill in U.S. history. They provided support in placing containment booms, skimming oil from the water's surface, cleaning up beaches, decontaminating equipment, administrative work and a variety of other tasks. The new study is based on an analysis of exit surveys answered by nearly 5,000 of those Coast Guard members after their deployment. In addition to being exposed to oil, some responders were exposed to the dispersants used to break up the oil. "We saw (greater effects on those exposed to dispersants as well as oil) with respiratory symptoms. Now we're also seeing it with neurological symptoms," Rusiecki said. Among those who were exposed to oil and dispersants, 65 percent reported experiencing headaches and 40 percent reported light-headedness or dizziness. Among those who were exposed to oil alone, 49 percent reported experiencing headaches and 20 percent reported light-headedness or dizziness. And among those who

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were not exposed to oil or dispersant, 26 percent reported headaches and 6 percent reported light-headedness or dizziness. Very few responders reported being exposed to dispersants but not oil. So, the researchers did not focus on dispersant exposure in isolation. Heat likely played a role in exacerbating neurological symptoms, Rusiecki said. The most intense clean-up efforts during the oil spill response occurred during the summer months. While the study focused on short-term neurological symptoms, Rusiecki said she intends to use data from medical records to see whether exposure to oil and dispersants caused any long-term neurological effects.

The New Orleans Advocate, 11 August 2019

https://www.nola.com

## Cigarette butts are toxic plastic pollution. Should they be banned?

*2019-08-15*

**Trillions of cigarette butts are thrown into the environment every year, where they leach nicotine and heavy metals before turning into microplastic pollution.**

Smokers around the world buy roughly 6.5 trillion cigarettes each year. That's 18 billion every day. While most of a cigarette's innards and paper wrapping disintegrate when smoked, not everything gets burned. Trillions of cigarette filters—also known as butts or ends—are left over, only an estimated third of which make it into the trash. The rest are casually flung into the street or out a window. "There's something about flicking that cigarette butt," says Cindy Zipf, executive director of Clean Ocean Action. "It's so automatic." Cigarette filters are made of a plastic called cellulose acetate. When tossed into the environment, they dump not only that plastic, but also the nicotine, heavy metals, and many other chemicals they've absorbed into the surrounding environment. A recent study found that cigarette butts inhibit plant growth. They also routinely get into waterways, and eventually oceans. Zipf said cigarette butts have long been at or near the top of the list of items her organization finds during beach clean-ups. The billions more that remain in the water are hazardous to marine animals, which can eat them, she said. "They look a lot more like a morsel of food on a sea surface," says Zipf. The pollution problem has only gotten worse in recent years as e-cigarettes have become more popular, she said, because those too are largely made of plastic. "It's becoming so pervasive," says Zipf, of both e-cigarette use and the accompanying plastic waste. "It's just a different form of the same thing."

From tobacco to plastics

# Curiosities



People have been smoking or chewing tobacco for millennia. By the 1800s paper cigarettes had joined cigars, pipes, and snuff as common forms of tobacco consumption. But the invention of the cigarette rolling machine at the end of the century—which drastically increased production—started the cigarette on its path to popularity. The 20th century saw an explosion of smoking. In 1900 American adults smoked an average of 54 cigarettes per year. By 1960, that number had climbed to more than 4,000. For most of that period, cigarette filters were non-existent. But, slowly, the health impacts of smoking became clear. Starting in the late 1930s, scientists began making connections between cigarettes and public health risks. In 1957 the Surgeon General officially declared a causal link between smoking and lung cancer. By 1964 the agency had commissioned and released a comprehensive report highlighting "a 70 percent increase in the mortality rate of smokers over non-smokers." As public concern mounted, the tobacco companies scrambled for solutions, one of which was cigarette filters. "There was this whole attempt to reduce tar and nicotine," says Tom Novotny, an epidemiologist at San Diego State University who was one of the first people to research the environmental impacts of cigarettes. By the late 1950s, sales of filtered cigarettes had overtaken those of unfiltered cigarettes. Tobacco companies, Novotny said, tried a variety of different filter materials, such as cotton, charcoal, and food starch, before landing on a plastic fibre called cellulose acetate, which remains the polymer of choice today. "There's still widespread misunderstanding about what [filters] are made of," says Novotny. "A lot of smokers think it's biodegradable already." Filters can take years to degrade and, even as they do, they break down into tiny pieces of plastic, called microplastics, which are an increasing hazard in waterways and oceans. Cigarette butts also carry a heavy load of toxic materials that can be harmful to nearby marine life, a threat that Novotny tested in the lab. "One cigarette butt in a litre [of water]," he said of his findings, "kills half the fish."

A new plastic washes up

When Cindy Zipf goes out on her beach clean-ups, it's normal for her to find cigarette butts. But about five years ago Zipf started to see a new kind of plastic item: e-cigarettes. "They're hard plastic all around," she says. "They look like little drives for computers." Electronic cigarettes generally consist of four components: the cartridge or pod that holds the "e-juice" solution, a heating element, a battery, and a mouthpiece. While the pods are now replaceable, at first the whole contraption was entirely single-use. The plastic and circuitry all went straight into the garbage—or the street. The use of e-cigarettes has skyrocketed. The leading manufacturer, Juul,

for example, saw its sales increase nearly sevenfold between 2014 and 2017. The FDA called the rise in use among youth especially "startling." Today, more than 10 million Americans use e-cigarettes. As the prevalence of e-cigarettes has grown, so has the need to get rid of the waste. But their mix of electronic components and nicotine puts them in a grey area for disposal, said Yogi Hendlin, a professor at the University of California, San Francisco and one of the leading researchers on the subject. "E-cigarettes are viewed both as hazardous waste and e-waste," he explains, noting that when he goes to high schools, he often finds "hundreds" of Juul pods in the parking lot. "From the regulatory side we haven't been able to find a way to deal with this." The effects of e-cigarette waste on the environment are only starting to be studied. Novotny, for instance, has begun looking into the toxicity to marine life, as he did with cigarette butts. On beaches, Zipf said the plastic pods were piling up so fast that her organization was considering making them a permanent fixture of the collection scorecard that volunteers take with them as they tally items. Zipf says: "We seem to keep coming up with new and different uses—wasteful uses—for plastic."

Ban the butt?

The city of San Francisco spends some $7.5 million a year cleaning up cigarette butts, and is far from the only municipality dealing with such waste. "It's the last remaining acceptable form of littering," says Novotny. "People are more likely to pick up their dog poop than cigarette butts." Novotny proposes a radical solution: Ban cigarette butts altogether. Filters, he said, haven't been shown to improve health outcomes. They may even be making the problem worse because they make smoking a less harsh experience and give people a sense that they are doing less harm. He also notes the environmental benefits, and has argued for a ban on single-use plastic filters, a step that the California state senate is currently considering. "It's a major intervention that I think could work," he says. Hendlin agreed that change was only likely to come through legislative pressure. He pointed to documents showing that the R.J. Reynolds tobacco company was exploring biodegradable filters as far back as the 1970s, yet cellulose acetate remains the standard today. Most companies, he says, have also explored alternative filter materials, but "haven't pulled the trigger because they haven't been forced." "They are ready, if unwilling," says Hendlin. Companies argue that filters are key to keeping emissions in line with regulations and that it's consumers who are holding up adoption of filter replacements. Imperial, one of the largest tobacco brands in the country, tested paper filters in France, but according to a spokesperson, "Sadly, it was commercially unsuccessful." Consumers, he said, didn't like

the taste. As Simon Cleverly, with British American Tobacco, puts it: "There is currently no feasible alternative to cellulose acetate for filters." A number of companies claim to make more environmentally friendly products, such as Smokey Treats and Greenbutts. The president of Greenbutts, Tadas Lisauskas, says the company is in negotiations with major manufacturers to implement their filters. But both Novotny and Hendlin are sceptical that start-ups like these address the root of the problem: people's proclivity to litter cigarette butts. E-cigarettes pose a similarly vexing plastic problem. The pods must be rinsed before being thrown in the normal trash and as of 2018, Juul tweeted, it didn't "currently have a recycling program available." Hendlin says reengineering e-cigarettes to use less, or no, plastic would be an expensive proposition that companies seem loathe to undertake. He suggests that a deposit system, such as the one for propane canisters, might be a better route. "When you went to buy your next set of pods," he says, "you exchange your old cartridges for your new ones and you get your [money] back." A spokesperson for Juul Labs says the company is already exploring a similar option and testing it internally. "We are committed to responsible stewardship and environmental sustainability," he says in an email. "We take environmental impact seriously." There have been some steps toward addressing the plastic hazards that cigarettes pose. In 2016 India banned the use of plastic packaging for tobacco products. This year in New Jersey, a law went into effect that limits smoking and vaping in public parks and on beaches. But Zipf says many people will probably continue to flick their butts or drop their pods—and the plastics that accompany them—where they aren't supposed to. "I think it's ignorance of convenience," she says. "There's really no excuse for it."

National Geographic, 9 August 2019

www.nationalgeographic.com.au

**The brains behind Atomik vodka want to bring back agriculture to the region devastated by the nuclear disaster, starting with artisanal booze.**

## Scientists made vodka from grain grown at Chernobyl, and it's totally drinkable and doesn't glow

*2019-08-15*

More than three decades after a reactor at the Chernobyl nuclear power plant exploded and caught fire—sending radioactive waste as far away as the U.K.—the 1,600-square-mile exclusion zone around the plant is still largely uninhabited. But thousands of people live nearby, in the "Zone of Obligatory Resettlement," and struggle to make a living. One project aims to help rebuild the economy with a new product: vodka made from grains and water near the area. Called Atomik, the booze isn't yet on the

market. But scientists from the U.K.'s University of Portsmouth who have been studying radioactivity from crops in the area made one experimental bottle of the product, and found that (despite the name) the vodka is radiation-free. They hope to begin selling it. "The most important thing for these abandoned areas around the main exclusion zone, what they need, is jobs and investment and economic growth," Jim Smith, a University of Portsmouth researcher, said in a video about the project. "What we're trying to do is make an artisan, kind of homemade, but high-quality grain spirit from grain grown in the regions affected by the Chernobyl accident. And we've subjected this to a battery of tests, and we can't find any radioactivity. There's no plutonium. No americium, no caesium, no strontium. So, from a radiological point of view, it's safe to drink." The grain did have a small amount of radiation when it was harvested, but the distilling process removed it. The water comes from a deep aquifer in the town of Chernobyl that remained uncontaminated. The researchers say that other crops could likely be grown in the area, though agriculture is still prohibited. The scientists plan to create a new social enterprise, called the Chernobyl Spirit Company, to market the product. They'll still need to pass some legal hurdles before that can happen, but hope to begin small-scale experimental production later this year.

Fast Company, 9 August 2019

http://www.fastcompany.com/

## Exclusive: Maker of 'forever chemicals' cuts food packaging products

*2019-08-15*

Chemical giant and Teflon maker Chemours have quietly stopped making some non-stick coatings used in disposable food packaging amid public debate about their health effects, the company told POLITICO. The DuPont spinoff said it no longer manufactures three products containing PFAS, or per- and polyfluoroalkyl substances, in the U.S. or globally that were applied to paper food packaging to resist oil and grease. The company told POLITICO it has also asked the Food and Drug Administration to voluntarily withdraw approval of the products. Chemours did not comment on why it decided to stop making the three PFAS-based products, only stating that its business is more focused on other markets like consumer electronics, energy storage and automotives. Manufacturers of PFAS maintain the chemicals are not a public health risk, and FDA previously backed them up, signing off on the safety of dozens of food-packaging uses of the chemicals. However, the agency said this summer it had launched a

review because new evidence suggests they may be harmful. "Since our inception as a company in 2015, food packaging has never been a focus for Chemours," the company said in a statement, adding that it has no intention of developing any new PFAS-based products for food packaging. "We do not believe our withdrawals … will have any impact on the food packaging marketplace — we have not meaningfully participated in this marketplace for some time." Chemours' move comes as the Trump administration faces pressure from states and public health advocates to reduce Americans' exposure to PFAS, a class of nearly 5,000 chemicals that since the 1940s have been used in everything from cookware and fabric to carpeting and firefighting foam. They are commonly found in sandwich and dessert wrappers, as well as compostable paper bowls and plates and fast-food boxes. Chains like Chipotle and Sweetgreen use packaging containing PFAS, The New Food Economy reported recently. Some PFAS are known to cause health problems in part because they are extremely long-lasting and accumulate over time in the human body and the environment. As FDA reviews the chemicals, some states are taking the lead in efforts to ban PFAS in everyday products, including food packaging, to protect water quality and public health. Manufacturers including Chemours, DuPont and 3M are also facing a litany of lawsuits over PFAS contamination. Chemical companies years ago stopped making two of the most well-studied PFAS, known as PFOS and PFOA, because of links to kidney and testicular cancer, hypertension and developmental and reproductive issues. They were removed from food packaging in 2011 under an agreement between FDA and major manufacturers like 3M, BASF and DuPont. But those two chemicals have been replaced by newer PFAS variations that chemical companies say are significantly safer. A number of these have been approved by FDA for use in food packaging over the past two decades. The agency evaluates the safety of non-stick coatings and other food-packaging products through an obscure notification system that relies on data submitted by chemical manufacturers, such as what the coatings are made from, their toxicity and how much of a given chemical could migrate into food. FDA said it limits these uses for food packaging to ensure consumer safety. But in June the agency announced it was reviewing the approvals because recent studies suggested newer PFAS on the market may pose a risk to human health. FDA is working with other federal agencies to determine next steps. It is unclear whether Chemours' decision to discontinue three PFAS-based substances was related to the FDA review. The company did not comment on what portion of its business has been dedicated to food-packaging chemicals. Chemours' latest financial report states that it earned $2.9 billion last year from its line of "fluoroproducts." The products include Teflon, repellents for leather

and floor tile, foam used to extinguish fires, refrigerants and industrial cleaners, as well as a "foam blowing agent" for food packaging, according to the company's website. Chemours makes at least six other coatings that come into contact with food, primarily through use in food processing equipment, that appear to contain PFAS, according to a review of an FDA database. The company did not return a request for comment on whether it has stopped, or plans to stop, manufacturing those products. There are no estimates of how much of the food-packaging supply is made with PFAS-based chemicals, said Lynn Dyer, president of the Foodservice Packaging Institute, a trade association. She said consumers should not be concerned about the chemicals because FDA's review process is rigorous. The industry is working on finding alternatives to PFAS-based products that perform well and could be marketed at a competitive price, she added. Erika Schreder, science director at Toxic-Free Future, an advocacy and research group that lobbies policymakers to strengthen chemical protections, said Chemours' decision reflects the reality that the chemicals are "dangerous and unnecessary." "When PFAS is used in food packaging, we end up with these persistent chemicals in our food and in our bodies, and when we're done eating, the packaging ends up contaminating compost and water," Schreder told POLITICO.

Politico, 9 August 2019

http://www.politico.com/

## Breast Milk's Unique Composition May Actually Help Babies Tell Day From Night

*2019-08-15*

**Human breast milk is more than a meal – it's also a clock, providing time-of-day information to infants.**

Human breast milk is more than a meal – it's also a clock, providing time-of-day information to infants. The composition of breast milk changes across the day, giving energizing morning milk a different cocktail of ingredients than soothing evening milk. Researchers believe this "chrononutrition" may help program infants' emerging circadian biology, the internal timekeeper that allows babies to distinguish day from night. What happens, though, when babies drink milk that does not come directly from the breast, but is pumped at different times of day and stored in advance of feeding? Scientists have rarely considered the potential effects of "mistimed" milk on infants' development, but the implications are potentially far-reaching. As psychologists who study the biology of parenting, we teamed up with Laura Glynn, Caroline Steele and Caroline Bixby to investigate the evidence for breast milk as a timekeeper.

# Curiosities



Body clocks over the course of the day

Sleep, eating and energy levels all show circadian rhythms, which means they follow a daily cycle. As any parent who has sleepwalked through a 3am feeding knows, infants are not born with these rhythms fully set. Instead, their sense of day and night develops over the first weeks and months of life, thanks to cues like sunlight and darkness. Babies vary: Some show predictable circadian fluctuations in hormones linked with alertness, sleep and appetite, and can sleep for long stretches shortly after birth, whereas others seem to have their daily rhythms upside-down for months. Delays in the development of circadian biology can increase the risk of colic and lead to growth and feeding problems. But scientists know very little about why circadian biology comes online on such different schedules for different infants. Breast milk may help program infant circadian rhythms, helping to explain why some parents of newborns enjoy long full nights of sleep, whereas others struggle to get their infants on a schedule.

Milk in flux

Breast milk changes dramatically over the course of the day. For example, levels of cortisol – a hormone that promotes alertness – are three times higher in morning milk than in evening milk. Melatonin, which promotes sleep and digestion, can barely be detected in daytime milk, but rises in the evening and peaks around midnight. Night milk also contains higher levels of certain DNA building blocks which help promote healthy sleep. Day milk, by contrast, has more activity-promoting amino acids than night milk. Iron in milk peaks at around noon; vitamin E peaks in the evening. Minerals like magnesium, zinc, potassium and sodium are all highest in the morning. Daytime milk may pack a special immune punch. Among mothers who provided researchers with milk samples across the first month postpartum, immune components – including key antibodies and white blood cells – looked higher in day milk compared to night milk. Another study found higher levels of a component important for immune system communication in day milk compared to night milk. While it's clear that milk changes over the course of the day, scientists know little about what this means for infant health. Researchers do know that the hormones and immune components in breast milk are passed along to infants, and that infants are starting to develop and refine their own circadian rhythms during the first months of life. It's plausible that the chronosignals in breast milk would help to shape infants' own circadian biology. Differences in infant feeding patterns might help explain why there's such variability in the development of these daily rhythms from one infant to another.

# Curiosities



Mistimed messages in milk?

For most of human history, breast milk could only be consumed directly from the breast, meaning that milk was always ingested right when it was produced. Now, with the advent of breast pumps and refrigeration, that's no longer the case. According to a 2005-2007 survey, over 85 percent of breastfeeding mothers in the US have pumped their milk. What happens when babies drink night milk in the morning, or morning milk in the late afternoon? We don't know for sure, because this question has been woefully understudied. Offering an infant a bottle of morning milk in the evening, with its high cortisol and low melatonin, might be the nutritional equivalent of flipping the lights on right before bedtime. If chronosignals in milk do indeed help to calibrate infant circadian biology, then infants who drink "mistimed" milk may struggle more with sleep, digestion and development. There's a fairly easy fix, of course. Mothers can label their milk with the time it was pumped and coordinate infant feedings to offer morning milk in the morning, afternoon milk in the afternoon and night milk at night. If this became standard practice in neonatal intensive care units, we think that thousands of infants could benefit from milk served right on time, potentially helping them better regulate their circadian rhythms. Many NICUs have already adopted practices designed to better regulate infant circadian biology, such as dimming the lights at night, so time-matched milk would be a logical next step. Similarly, milk banks that accept donor milk could sort milk into batches by time of day. There's a simpler alternative to time-matching pumped milk: boosting women's ability to breastfeed their infants right on the spot by offering reasonable paid parental leave policies. Mothers who can feed their infants directly don't need to worry about organising their milk by time of day, and milk that is offered straight from the breast may confer other health benefits as well. Research continues to explore the role of breast milk in timekeeping and its impact on infant health and development. If time-matched milk does turn out to be a key way to help set babies' internal clocks, the public health case grows stronger for policies that support mothers' ability to stay home with their infants during the first year of life.

Science Alert, 12 August 2019

http://www.sciencealert.com.au

# Technical Notes

CHEMWATCH

## (NOTE: OPEN YOUR WEB BROWSER AND CLICK ON HEADING TO LINK TO SECTION)

## ENVIRONMENTAL RESEARCH

Endocrine disrupting effects in western mosquitofish Gambusia affinis in two rivers impacted by untreated rural domestic wastewaters

Trends in the Bioremediation of Pharmaceuticals and Other Organic Contaminants Using Native or Genetically Modified Microbial Strains: A Review

Comprehensive Target Analysis for 484 Organic Micropollutants in Environmental Waters by the Combination of Tandem Solid-Phase Extraction and Quadrupole Time-of-Flight Mass Spectrometry with Sequential Window Acquisition of All Theoretical Fragment-Ion Spectra Acquisition

Occurrence and Degradation Potential of Fluoroalkylsilane Substances as Precursors of Perfluoroalkyl Carboxylic Acids

Electrophilicity index as a critical indicator for the biodegradation of the pharmaceuticals in aerobic activated sludge processes

## MEDICAL RESEARCH

Exploring the Effects of Vitamin D Supplementation on Cognitive Functions and Mental Health Status in Subjects Under Methadone Maintenance Treatment

α7 Nicotinic Acetylcholine Receptor Signalling Modulates Ovine Foetal Brain Astrocytes Transcriptome in Response to Endotoxin

Nanoparticle exposure driven circulating bioactive peptidome causes systemic inflammation and vascular dysfunction

Nickel allergy and allergic contact dermatitis: A clinical review of immunology, epidemiology, exposure, and treatment.

Attack-related damage of thalamic nuclei in neuromyelitis optica spectrum disorders

## OCCUPATIONAL RESEARCH

An Online Survey of Occupational Hazards in Brazilian Aquaculture.

# Technical Notes



Reduction of operator radiation exposure using a passive robotic device during fluoroscopy-guided arterial puncture: an experimental study in a swine model

Filaggrin variations are associated with PAH metabolites in urine and DNA alterations in blood

Removal of F-53B as PFOS alternative in chrome plating wastewater by UV/Sulfite reduction

Characterisation of airborne particles from cleaning sprays and their corresponding respiratory deposition fractions

## PUBLIC HEALTH RESEARCH

Evaluating access to essential medicines for treating childhood cancers: a medicines availability, price and affordability study in New Delhi, India

Phthalates in infant cotton clothing: Occurrence and implications for human exposure

Building and Applying Quantitative Adverse Outcome Pathway Models for Chemical Hazard and Risk Assessment

Non-targeted screening and analysis of volatile organic compounds in drinking water by DLLME with GC-MS

Association between perfluoroalkyl substance concentrations and blood pressure in adolescents