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

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### ASIA PACIFIC

#### **TGA assessed claim for assessed listed and registered complementary medicines**

2019-06-20

The Therapeutic Goods Administration (TGA) has implemented the 'TGA assessed' claim for sponsors of assessed listed medicines and registered complementary medicines. In response to the Medicines and Medical Devices Regulation Review (MMDR), the Government accepted a recommendation to allow sponsors to publish a claim that their medicine has been assessed by the TGA for efficacy where that medicine has undergone pre-market evaluation by the TGA. In May 2018 the TGA released a consultation paper: Options for the implementation of a claimer for efficacy assessed non-prescription medicines and sought comments on the design and implementation of the TGA assessed claim. A response has since been published on the TGA website.

#### What is the TGA assessed claim?

The TGA assessed claim is a symbol and/or statement that indicates that a medicine has had the efficacy for its indications (a medicine's claimed purpose or health benefit) assessed by the TGA. It can only be used in accordance with the TGA's authority. The implementation of the TGA assessed claim is intended to:

- support consumers to make better informed purchasing decisions by improving the transparency about whether efficacy claims for certain medicines have been independently assessed by the TGA;
- improve consumer awareness about the medicine's regulatory framework and the different levels of assessment undertaken by the TGA;
- provide an incentive for product sponsors to improve the standards of evidence and extend the evidence base for certain medicines

The TGA assessed claim is not a recommendation by the TGA and does not advocate that a medicine with the claim is better for a person than other medicines without the claim. It is not mandatory, and therefore not all medicines whose efficacy has been assessed will display it.

#### What medicines does it apply to?

Assessed listed medicines and registered complementary medicines which have undergone a pre-market assessment of efficacy by the TGA are

**The Therapeutic Goods Administration (TGA) has implemented the 'TGA assessed' claim for sponsors of assessed listed medicines and registered complementary medicines.**

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eligible to use the TGA assessed claim on their medicine label and other advertising material. Assessed listed medicines are different to other listed medicines. Sponsors of listed medicines (with an 'AUST L' ARTG number) are required to hold evidence for the efficacy of their listed medicine. However, this evidence is not pre-market assessed by the TGA. Assessed listed medicines (with an 'AUST L(A)' ARTG number) have undergone a TGA pre-market assessment of the efficacy of the medicine's indications. Listed or registered complementary medicines that have not undergone pre-market efficacy assessment by the TGA are not eligible to use the TGA assessed claim. For example, grandfathered registered complementary medicines will not be eligible to use the TGA assessed claim unless the sponsor applies to the TGA to complete an assessment of the medicine's efficacy. Only medicines with indications supported by scientific evidence and approved for inclusion by the TGA will be eligible to use the TGA assessed claim.

Prescription and over the counter (OTC) medicines will not display the TGA assessed claim.

### What does the TGA assessed claim look like?

The TGA assessed claim can be displayed as the approved symbol and/or statement. The symbol and statements are available at: <https://www.tga.gov.au/tga-assessed-claim-assessed-listed-and-registered-complementary-medicines>

### How can the TGA assessed claim be used?

The specific rules of how the TGA assessed claim can be used on the label and in advertising will be set out in a legislative instrument. These rules apply to the sponsor of the medicine and also apply to advertisers of the medicine who are not the sponsor (e.g. secondary advertisers such as retailers or pharmacies).

### Using the TGA assessed claim on the medicine label

Sponsors can only use the approved symbol and/or statement on their medicine label without any modification. If the symbol is used, the statement must also be used. However, the statement can be used on its own without the symbol. The symbol/statement must not be more prominent than the active ingredients, warnings or other essential information for the medicine.

### Using the TGA assessed claim in other advertising materials

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The use of the TGA assessed claim in any advertising must comply with the advertising requirements set out in the *Therapeutic Goods Act 1989* and the *Therapeutic Goods Advertising Code*, as amended from time to time. Advertisements may show images of the medicine label, including the TGA assessed claim (symbol and/or statement), but may not use the TGA assessed symbol or statement independent of the label or the image of the label. No audible commentary or further written commentary on the TGA assessed claim can be made. The TGA assessed claim must not be more prominent than the mandatory statements in an advertisement (even when used on a pack shot). The advertising cannot imply that the TGA recommends the medicine or advocates the use of the medicine above other medicines that do not use the TGA assessed claim.

### How will the TGA assessed claim be regulated?

The TGA will specify the circumstances in which the TGA assessed claim can lawfully be used in an instrument of authorisation that will be made under the *Therapeutic Goods Act 1989*. An authorisation to use the TGA assessed claim is required because a claim that suggests or implies that goods have been recommended, approved or endorsed by the TGA would, unless authorised, breach the *Therapeutic Goods Act 1989* and the *Therapeutic Goods Advertising Code*. Sponsors will be required to ensure that use of the TGA assessed claim, whether on the label or otherwise, is in accordance with the instrument of authorisation. Sponsors will also be required to take steps to ensure that any advertiser of its medicine also ensures that use of the TGA assessed claim is in accordance with the instrument of authorisation. Use of the TGA assessed claim otherwise than in accordance with the instrument of authorisation is likely to breach the *Therapeutic Goods Act 1989* and the *Therapeutic Goods Advertising Code (No.2) 2018*, which may result in criminal and/or civil penalties, and/or cancellation of a medicine from inclusion in the Australian Register of Therapeutic Goods. A sponsor seeking to use the TGA assessed claim on its label must submit the label to the TGA for approval prior to including the TGA assessed claim on its label.

### How do I access the TGA assessed claim for my assessed listed or registered complementary medicine?

If a sponsor wishes to use the TGA assessed claim for a new assessed listed or new registered complementary medicine, they must provide a medicine label with the TGA assessed claim for TGA pre-market approval. Sponsors can request the TGA assessed symbol file and usage guidelines by emailing: [complementary.medicines@health.gov.au](mailto:complementary.medicines@health.gov.au). If a sponsor wishes

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to use the TGA assessed claim for an existing registered complementary medicine that has undergone a pre-market assessment of efficacy by the TGA, they must have their new label assessed by the TGA before the claim can be used. Applications for changes to the medicine label which only relate to the use of the TGA assessed claim can use the 'OT1' code. This will attract a RCMC1 application fee – refer to TGA's Schedule of fees and charges.

TGA, 12 June 2019

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

### New Agricultural Active Constituent benzovindiflupyr

2019-06-20

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has before it an application for the approval of a new active constituent, benzovindiflupyr, for use as a fungicide in agricultural products.

- Common Name: benzovindiflupyr
- IUPAC Name: rac-N-[(1R,4S)-9-(Dichloromethylidene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-3-(difluoromethyl)-1-methyl-1H-pyrazole-4-carboxamide
- Chemical Abstracts Name: N-[9-(dichloromethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-3-(difluoromethyl)-1-methyl-1H-pyrazole-4-carboxamide
- CAS Number: 1072957-71-1
- Molecular Formula: C<sub>18</sub>H<sub>15</sub>Cl<sub>2</sub>F<sub>2</sub>N<sub>3</sub>O
- Molecular Weight: 398.2 g/mol
- Chemical Family: Pyrazole carboxamide
- Mode of Action: Inhibition of mitochondrial complex II respiration acting on the enzyme succinate dehydrogenase. Mainly a preventative fungicide with limited curative activity.

#### Summary of the APVMA's Evaluation

The APVMA has evaluated the chemistry and manufacturing aspects of benzovindiflupyr active constituent (identification, physicochemical properties, manufacturing process, composition, quality control procedures, batch analysis results and analytical methods) and found them to be acceptable. On the basis of the data provided, and the toxicological assessment, it is proposed that the following APVMA Active Constituent Standard be established for benzovindiflupyr active

**The Australian Pesticides and Veterinary Medicines Authority (APVMA) has before it an application for the approval of a new active constituent, benzovindiflupyr, for use as a fungicide in agricultural products.**

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constituent: Constituent Specification Level benzovindiflupyr 960 g/kg minimum Impurities of toxicological significance are not expected to occur in benzovindiflupyr as a result of the raw materials and the synthetic route used. The APVMA has considered the toxicological aspects of benzovindiflupyr, and concluded that there are no toxicological concerns to the approval of this active constituent. The ADI for benzovindiflupyr was established at 0.05 mg/kg bw/d. The ARfD for benzovindiflupyr was established at 0.1 mg/kg bw. The Scheduling Delegate made a delegate-only decision to include benzovindiflupyr in Schedule 6 of the Poison Standard, with an implementation date of 1 February 2019. The APVMA is satisfied that the proposed importation and use of benzovindiflupyr would not be an undue hazard to the safety of people exposed to it during its handling and use. The agency now invites any person to submit a relevant written submission as to whether the application for approval of benzovindiflupyr should be granted. Submissions should relate only to matters that are considered in determining whether the safety criteria set out in section 5A of the Agvet Code have been met. Submissions should state the grounds on which they are based and must be received by the APVMA within 28 days.

APVMA Gazette, 18 June 2019

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

### **MOFCOM Initiates Expiry Review Investigation on Acetone Imported from Japan, Singapore, South Korea and Taiwan**

2019-06-20

On 6 June, China's Ministry of Commerce (MOFCOM) issued Announcement No. 25 of 2019 on the initiation of a review investigation into anti-dumping measures on acetone imported from Japan, Singapore, South Korea and Taiwan. The investigation will run from 8<sup>th</sup> June 2019 to 7<sup>th</sup> June 2020. State Council Tariff Commission decided to continue to impose the same tariffs on acetone imported from Japan, Singapore, South Korea and Taiwan according to the Announcement No.40 of 2008 and Announcement No. 40 of 2014 issued by MOFCOM.

Chronology of events:

- On 8<sup>th</sup> June, 2008, MOFCOM issued Announcement No.40 of 2008, imposing anti-dumping measures on Japan, Singapore, South Korea and Taiwan, which would begin on 9<sup>th</sup> June, 2008 and run for 5 years.

**China MOFCOM decided to conduct an expiry review investigation of anti-dumping measures on acetone imported from Japan, Singapore, South Korea and Taiwan since 8 June 2019.**

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- On 9<sup>th</sup> September 2010, MOFCOM issued Announcement No. 54 of 2010, deciding to adjust the anti-dumping tariffs on acetone imported from South Korea Kumho P&B Chemical Co., Ltd.
- On 6<sup>th</sup> June 2014, MOFCOM issued Announcement No. 40 of 2014, deciding to extend the implementation of anti-dumping measures for another 5 years from the beginning of 8<sup>th</sup> June 2014.
- On 9<sup>th</sup> October 2018, MOFCOM issued Announcement No.77 of 2018, announcing that the anti-dumping measures on acetone imported from Japan, Singapore, South Korea and Taiwan would expire on 7<sup>th</sup> June 2019, and relevant industries, natural person, legal person and related organisations of industries in Chinese Mainland could submit the application for expiry review within 60 days before the expiry date. There were 6 companies in Chinese Mainland representing the acetone sector in China's Mainland that submitted the expiry review application on the anti-dumping measures.

According to the relevant anti-dumping regulations, MOFCOM decided to conduct expiry review investigation of anti-dumping measures on acetone imported from Japan, Singapore, South Korea and Taiwan starting on 8<sup>th</sup> June 2019.

Further information is available at:

- [Announcement No. 25 of 2019](#)
- [Announcement No.40 of 2008](#)
- [Announcement No. 40 of 2014](#)
- [Announcement No. 54 of 2010](#)

Chemlinked, 14 June 2019

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

### China Consults on New National Standard for Rare Earth

2019-06-20

On 14 June 2019, Ministry of Industry and Information Technology of the People's Republic of China (MIIT) issued a new mandatory national standard: Rare Earth Productions Packing, Marking, Transport and Storage. The packing, marking, transport, storage and quality certification requirements for rare earth products such as rare earth mineral products, rare earth compounds and rare earth metals are stipulated in the standard. The consultation will end on 15<sup>th</sup> July. There are seven chapters in the standard, of which chapter 4 and chapter 7 articulate mandatory requirements and the remaining chapters articulate recommended

**China's Ministry of Industry and Information Technology issued a new mandatory national standard: Rare Earth Productions Packing, Marking, Transport and Storage, and is currently seeking feedback from the public.**

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guidelines. Chapter 1 describes the content and scope of the standard. This standard applies to the following rare earth products: rare earth mineral products, single/mixed rare earth compounds, single/mixed rare earth metals, rare earth alloy, various kinds of rare earth material and other products. Chapter 2 lists other national standards referenced by this standard. From Chapter 3 to Chapter 7, the regulation of packing, marking, transport, storage and quality certification requirements for rare earth products are separately introduced. Packaging requirements for different kinds of products, package signs and transport signs, requirements for transport and storage and information to be included in the quality certificate are described in the standard in detail. The development of the rare earth industry is currently highly valued in China. Last month, President Xi went to investigate and research rare earth technology enterprises in Jiangxi Province, and learned about the production and operation of the company and the development of the local rare earth industry. In the future, the development of China's rare earth industry will receive more policy support. Further information is available at: [Rare Earth Productions Packing, Marking, Transport and Storage](#)

Chemlinked, 18 June 2019

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

## AMERICA

### US EPA to revamp pesticide evaluations

2019-06-20

The United States Environmental Protection Agency (EPA) is taking another stab at revising its process for assessing the risks of pesticides to endangered species. The move comes after manufacturers of three organophosphate insecticides urged the agency to abandon an approach established in 2015. The EPA used the method to evaluate chlorpyrifos, diazinon, and malathion. During the final days of the Obama administration, the agency concluded that all three are likely to adversely affect more than 1,000 endangered species. After pushback from the pesticide industry, the EPA is now proposing changes that would affect those determinations. Traditionally, the agency has used the maximum allowed usages stated on the pesticide label. Pesticide manufacturers claim that approach is overly conservative. The EPA now proposes evaluating risks using actual pesticide use data from various sources. Environmental groups argue that doing so would exclude from

**Agency floats revised process for assessing risks to endangered species**

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the analysis large geographical areas where no pesticide use data are available. Also, at issue is the need for the EPA to consult with the US Fish and Wildlife Service or the National Marine Fisheries Service, as the agency must do when it finds that pesticide use overlaps with the geographical area where an endangered species is found. The consultation is needed to determine whether the pesticide is likely to harm the species. Environmental groups have sued the EPA numerous times for failing to initiate such consultations. Hundreds of pesticides are scheduled for re-evaluation over the next decade, and each of those could affect numerous endangered species. Federal agencies do not have the resources to conduct thousands of consultations in a timely manner. Under the 2018 farm bill, the US Congress directed the EPA, the Council on Environmental Quality, and the Departments of Agriculture, Commerce, and the Interior to form an interagency working group to streamline the process. The group, which includes heads from each of the five agencies, met for the first time to discuss the EPA's proposal on June 6. Details from that closed-door meeting are scarce. "The Trump Administration is committed to carrying out the important responsibilities of the Endangered Species Act to protect and promote the recovery of species while recognizing that pesticides are a critical tool for protecting public health, supporting our farmers, and ensuring an abundant food supply," EPA administrator Andrew Wheeler said in a [June 6 statement](#).

The EPA heard mixed reviews about its proposal during a June 10 public meeting. "EPA's revised methods are an enormous step backwards," said Brett Hartl, director of government affairs at the environmental advocacy group Centre for Biological Diversity. Hartl claimed that the proposal deviates from 2013 recommendations by the National Academy of Sciences. The proposal also "abandons the collaborative and transparent work that the first biological evaluations represented," he said, referring to the three organophosphate evaluations conducted under the 2015 method, plus two other evaluations that the agency never released for carbaryl and methomyl. The proposal also limits consideration of pesticide drift to within 792 m (2,600 ft) of a treated field and pesticide runoff in water within 30 m of the site. "What happens if a pollinator of an endangered plant is exposed to a pesticide and killed, but that plant is more than 2,600 ft away from the treated field?" Hartl asked. "Under this approach, EPA is going to assert there is no effect." CropLife America, a trade group that represents the pesticide industry, supports the use of real-world data in the EPA's evaluations, Manojit Basu, CLA's managing director of science policy, said at the June 10 meeting. Such data better reflect where pesticides are used and target protection where it is most

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needed, he added. The EPA is seeking feedback on its proposed changes until July 1. CLA has asked the agency to extend the comment period by 45 days because of the complexity of the issue.

Chemical & Engineering News, 13 June 2019

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

### EPA Receives Manufacturer Requests for Risk Evaluations of DIDP and DINP

2019-06-20

On 14 June 2019, the United States Environmental Protection Agency (EPA) announced that on 24 May 2019, EPA received manufacturer requests for EPA to conduct risk evaluations of diisodecyl phthalate (DIDP) from ExxonMobil Chemical Company and diisononyl phthalate (DINP) from ExxonMobil Chemical Company, Evonik Corporation, and Teknor Apex, both through the American Chemistry Council's High Phthalates Panel. EPA states that both DIDP and DINP belong to a family of chemicals commonly referred to as phthalates, which are used as plasticizers in the production of plastic and plastic coatings to increase flexibility and were identified in the 2014 Update to the Toxic Substances Control Act (TSCA) Work Plan. Within 15 business days of receiving a facially complete request (*i.e.*, submission appears to be consistent with rule requirements), EPA states that it must notify the public of receipt of this request under 40 C.F.R. § 702.37(e)(2); and within 60 business days of receipt of a facially complete request, EPA will submit for publication the receipt of the request in the Federal Register, open a public docket for the request, and provide no less than 45 calendar days for public comment. After the comment period closes, the EPA has up to 60 days to either grant or deny the request to conduct a risk evaluation under 40 C.F.R. § 702.37(e)(6). More information on Manufacturer Requests is available on EPA's website.

National Law Review, 14 June 2019

<http://www.natlawreview.com>

### Ahead of most other countries, Colombia bans asbestos

2019-06-20

It took Colombia's congress 12 years, but the production, sale and use of asbestos was banned recently because of its health hazards. The ban will take effect in 2021 and allows local companies that use the mineral in its products a five-year transition period phase out the use of the

**On 14 June 2019, the United States Environmental Protection Agency (EPA) announced that on 24 May 2019, EPA received manufacturer requests for EPA to conduct risk evaluations of diisodecyl phthalate (DIDP) from ExxonMobil Chemical Company and diisononyl phthalate (DINP) from ExxonMobil Chemical Company, Evonik Corporation, and Teknor Apex, both through the American Chemistry Council's High Phthalates Panel.**

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mineral that is well known for causing, among other things, lung cancer. Ahead of the vote, the lawmakers heard citizens who had fallen ill to a variety of diseases believed to have been caused by asbestos. Other witnesses to the debate brought images of loved ones who died because of their exposition to the cancerous mineral that has long been used in construction. The House of Representatives, which had the final vote on the issue, unanimously agreed to the ban, much to the joy of the invited victims. The mining and export of the controversial mineral was also banned. According to the World Health Organization, more than 100,000 people die annually as a result of their exposure to asbestos fibres. According to website Pulzo, the debate to ban asbestos gained support after journalist Ana Cecilia Niño found she got cancer as a consequence of living next to a factory using the mineral and spent her dying days campaigning to make Colombia asbestos-free. The journalist died in 2012. Despite decades of civil lawsuits, industry lobbyists have so far been able to maintain asbestos legal in the United States. Also, in the European Union, legislation to ban or limit the use of the controversial mineral has been difficult to implement. Colombia is the seventh country in the world to fully ban asbestos.

Colombia Reports, 12 June 2019

<https://colombiareports.com>

### EUROPE

#### Council adopts stricter rules on the world's most dangerous chemicals

2019-06-20

The European Union (EU) has toughened the rules applicable to persistent organic pollutants, the UN-agreed list of dangerous substances. The regulation adopted by the Council ensures that people and the environment are better protected against these chemicals. The updated rules bring the regulation in line with the latest amendments to the Stockholm Convention, which provides the global legal framework for the elimination of the production, use, import and export of persistent organic pollutants. Several changes align the regulation more closely with the general EU legislation on chemicals. As a result of these changes, there will be more clarity, transparency and increased legal certainty for all parties involved in the implementation of the regulation. Persistent organic pollutants are chemical substances which are transported

**The European Union (EU) has toughened the rules applicable to persistent organic pollutants, the UN-agreed list of dangerous substances.**

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across international boundaries, far from their sources, and persist in the environment, bioaccumulate, and thereby pose a threat to human health and the environment. On 22 March 2018, the European Commission presented a proposal to recast the regulation on persistent organic pollutants. The Council adopted its position on the regulation on 28 November. Negotiations with the European Parliament started on 4 December 2018 and ended in a provisional agreement on 19 February 2019, which was endorsed by the ambassadors of EU member states. Following the adoption, which was the final step in the procedure, the regulation will enter into force on the twentieth day following that of its publication in the Official Journal of the European Union. It will be binding in its entirety and directly applicable in all member states. Further information is available at:

- [Text of the regulation](#)
- [Adoption note](#)
- [Statements](#)
- [Persistent organic pollutants: Provisional agreement on the world's most dangerous pollutants \(press release, 19/02/2019\)](#)
- [Commission proposal](#)

European Council, 13 June 2019

<https://www.consilium.europa.eu>

### Cutting emissions: Council adopts CO2 standards for trucks

2019-06-20

Trucks on Europe's roads will be cleaner from 2025. The Council recently adopted Europe's first-ever CO2 emission standards for trucks and other heavy-duty vehicles. Under the new rules, manufacturers will be required to cut carbon dioxide emissions from new trucks on average by 15% from 2025 and by 30% from 2030, compared with 2019 levels. These new rules represent a crucial step towards the decarbonisation and modernisation of Europe's road transport. This will benefit citizens, help us protect the environment and reach our climate goals, as well as support the long-term competitiveness of the transport sector. Those targets are binding, and truck manufacturers which do not comply will have to pay a financial penalty in the form of an excess emissions premium. In addition, specific measures will ensure the availability of robust and reliable data. Data will be obtained through on-board devices which monitor the actual fuel and energy consumption of heavy-duty vehicles. The Commission presented

**The European Union is setting CO2 emission standards for trucks for the first time**

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the proposal on this new regulation on 17 May 2018. It sets CO<sub>2</sub> emission performance standards for new heavy-duty vehicles and thereby helps member states achieve their emission reduction targets agreed under the effort sharing regulation. The European Parliament agreed its position on 14 November 2018, and the Council agreed its position (general approach) on 20 December 2018. Negotiations between the co-legislators started on 8 January 2019 and ended in a provisional agreement on 19 February 2019, which was later confirmed by the ambassadors of the member states. The formal adoption of the regulation by the Council today is the final step in the procedure. The regulation will enter into force on the twentieth day following that of its publication in the Official Journal of the EU. It is binding in its entirety and directly applicable in all member states. CO<sub>2</sub> emissions from heavy-duty vehicles including lorries, buses and coaches, represent around 6% of total CO<sub>2</sub> emissions in the EU and 27% of total road transport CO<sub>2</sub> emissions. Already a year ago, in June 2018, the Council had adopted a regulation which provides the technical basis for the new rules by setting out in detail how CO<sub>2</sub> emissions will need to be monitored and reported. Further information is available at:

- Text of the regulation
- Adoption note
- Statements
- Heavy-duty vehicles: Council presidency agrees with Parliament on Europe's first-ever CO<sub>2</sub> emission reduction targets for trucks (press release, 19/02/2019)
- Commission proposal
- CO<sub>2</sub> emissions of heavy-duty vehicles: Council adopts monitoring and reporting rules (press release, 25/06/2018)

European Council, 13 June 2019

<https://www.consilium.europa.eu>

### 12th adaption to CLP regulation published

2019-06-20

In April the 12th adaptation to technical progress (ATP) to the CLP Regulation came into force. The adaptation implements the sixth and seventh revised editions to the Globally Harmonised System (GHS) of Classification and Labelling in the EU. The adaptation includes changes in annexes to the CLP Regulation such as:

**In April the 12th adaptation to technical progress (ATP) to the CLP Regulation came into force.**

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- Addition of a new hazard class for desensitised explosives (explosive chemicals in which the explosive properties are suppressed by adding for instance water).
- Addition of a new hazard category for pyrophoric gasses (flammable gasses that are liable to ignite after brief contact with oxygen) in the hazard class for flammable gasses.
- Clarification and consistency in corrections to ensure consistency with GHS terminology.
- Definition of hazard classes has been updated to ensure a consistent terminology.
- References to test methods such as ISO methods or OECD guidelines have been updated to reflect development in test methods.

The rules are effective from 17 October 2020 but may be used for classification and labelling already now. Further information is available at: [View 12th adaption of the CLP Regulation in official EU languages](#)

DHI Newsletter, June 2019

<http://www.dhigroup.com>

## REACH Update

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### **ECHA's committees conclude on one restriction and 10 harmonised classification and labelling opinions**

2019-06-20

The Committee for Risk Assessment (RAC) adopted its opinion on the restriction proposal on granules and mulches used as infill material in synthetic turf pitches or in loose forms on playgrounds. The Committee for Socio-economic Analysis (SEAC) agreed its draft opinion on the same proposal. RAC and SEAC supported the restriction proposal by the Netherlands to not place the granules and mulches in question on the market if the sum of the listed polycyclic aromatic hydrocarbons (PAHs) in the materials is more than 20 mg/kg. A public consultation on the SEAC opinion will begin soon and the committee is expected to adopt an opinion in its September meeting. RAC also adopted 10 opinions for harmonised classification and labelling, including opinions on seven active substances used in biocidal products and/or plant protection products and three in industrial chemicals. RAC and SEAC agreed on eight draft opinions on uses of chromium trioxide. Furthermore, RAC and SEAC discussed key issues in 11 applications for authorisation, which were received by ECHA in February 2019. More information about the opinions is available in the annex. Further information is available at: [Annex to news release \(18 June 2019\)](#). The opinions will be available on [RAC's](#) and [SEAC's](#) web pages in the near future.

ECHA, 18 June 2019

<http://echa.europa.eu>

### **Changes to the inquiry process**

2019-06-20

The European Chemicals Agency (ECHA) has reorganised the processing of inquiries. Inquirers for most already registered or successfully inquired substances will now be quickly directed to the relevant *Co-Registrants* page in REACH-IT, based on the numerical identifiers they provide. For substances with ambiguous identifiers or where registrants or potential registrants do not exist, ECHA verifies the substance identity information. Nevertheless, previous and potential registrants are still responsible for discussing substance sameness and deciding whether their substances

**The Committee for Risk Assessment (RAC) adopted its opinion on the restriction proposal on granules and mulches used as infill material in synthetic turf pitches or in loose forms on playgrounds.**

## REACH Update

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can be registered together. Further information is available at: [Inquiry web page](#)

ECHA News, 19 June 2019

<http://echa.europa.eu>

### Opinion on substances in tattoo inks and permanent make up now available

2019-06-20

The final opinion of the Committees for Risk Assessment (RAC) and Socio-economic Analysis (SEAC) to restrict substances in tattoo inks and permanent make up (EC -, CAS -) is now available on ECHA's website. The final opinion is available at: [Final opinion](#). Further information is available at: [Registry of restriction intentions](#)

ECHA News, 19 June 2019

<http://echa.europa.eu>

### Public consultations launched on proposed restrictions of skin sensitising substances and PFHxS

2019-06-20

The European Chemicals Agency (ECHA) has published consultations on skin sensitising substances and perfluorohexane-1-sulphonic acid (PFHxS), its salts and related substances. The consultations are open from 19 June 2019 to 19 December 2019. ECHA's scientific committees welcome early comments by 19 August 2019 to assist them in the first discussion of the proposal in September 2019. Further information is available at: [Submitted restrictions under consideration](#)

ECHA News, 19 June 2019

<http://echa.europa.eu>

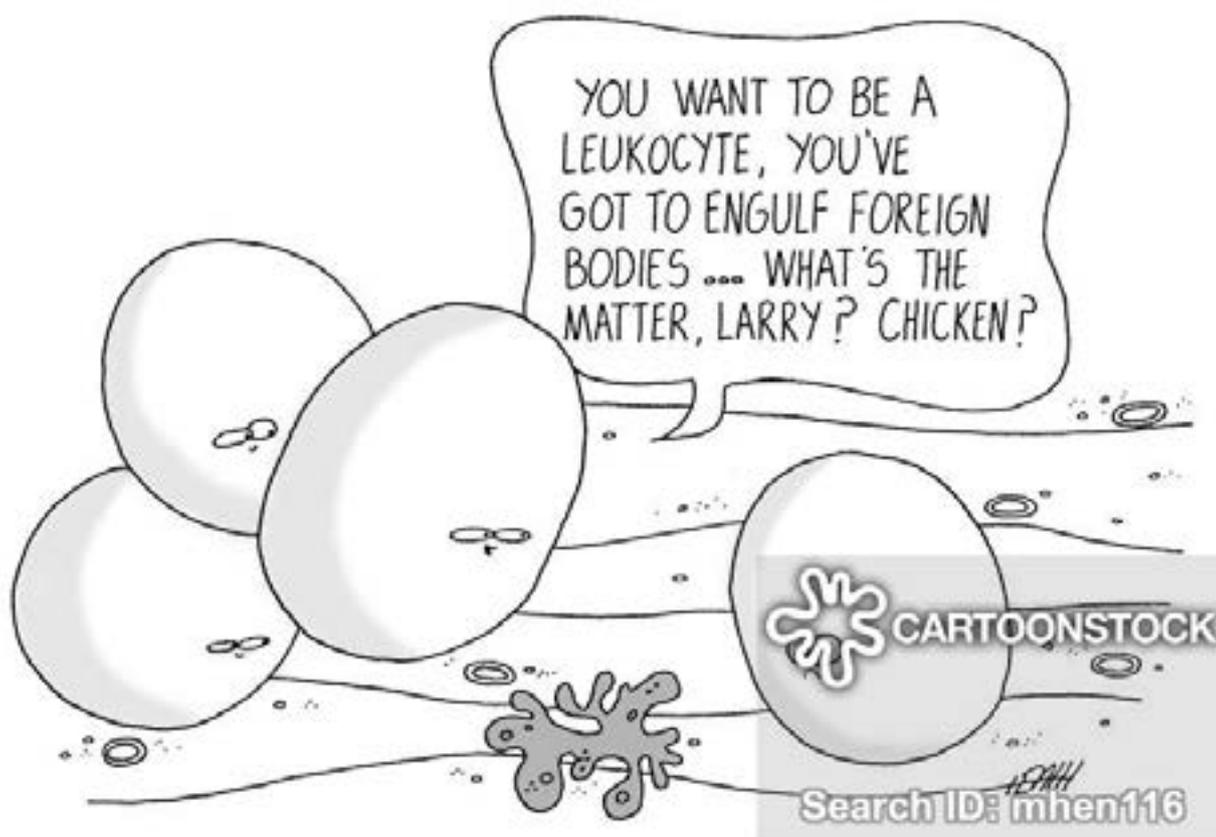
**The final opinion of the Committees for Risk Assessment (RAC) and Socio-economic Analysis (SEAC) to restrict substances in tattoo inks and permanent make up (EC -, CAS -) is now available on ECHA's website.**

## Janet's Corner

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### Blood (Peer) Pressure

2019-06-14



BLOOD (PEER) PRESSURE

## Hazard Alert

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### Simazine

2019-06-03

Simazine is an herbicide of the triazine class, with the molecular formula  $C_7H_{12}ClN_3$ . [1] Under normal conditions, Simazine is a white crystalline powder. When mixed with air, its dusts can be explosive. When heated, Simazine breaks down to give toxic fumes. It melts at 225 degrees Celsius. Simazine is not very soluble in water, but dissolves well in organic (carbon-containing) solvents. [2] Like atrazine, a related triazine herbicide, it acts by inhibiting photosynthesis. It remains active in the soil for 2-7 months after application. [1]

### USES [3]

Simazine is used as a pre-emergence herbicide for control of broad-leaved and grassy weeds on a variety of deep-rooted crops such as artichokes, asparagus, berry crops, broad beans, citrus, etc., and on noncrop areas such as farm ponds and fish hatcheries. Its major use is on corn where it is often combined with AAtrex. Other herbicides with which simazine is combined include: paraquat, on apples, peaches; Roundup or Oust for non-crop use; Surflan on Christmas trees; Dual on corn and ornamentals.

### ENVIRONMENTAL EFFECTS [2]

At high levels, Simazine is classed as toxic to wildlife, particularly aquatic organisms. Simazine applied to soils or hard surfaces may run off into water bodies. Some can also seep into groundwaters, although this is limited by its relatively low solubility in water. Simazine in the atmosphere is usually deposited onto soils or water bodies - and that which remains is broken down within a matter of hours. Simazine can persist in soils and waters for a considerable time and it has been found far from its point of release. For this reason, Simazine pollution is of concern at a global as well as local level.

### SOURCES & ROUTES OF EXPOSURE

#### Sources of Exposure [4]

People most likely to be exposed to simazine include:

- Farmers and agricultural workers who have handled or applied simazine, or herbicide mixtures containing simazine to fields or orchards;

## Hazard Alert

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- Family members that have lived on farms or orchards that have used simazine;
- Pesticide applicators who have used simazine to control weeds on vacant lots, right-of-ways, turf, golf fairways or on ornamental shrubs;
- People who have handled or laundered simazine-contaminated clothing;
- People who have worked in simazine manufacturing facilities;
- People who have consumed water contaminated with simazine;
- People who have consumed food products with residues of simazine or its breakdown products.

### Routes of Exposure [2]

Simazine can enter the body either by inhalation of contaminated air, ingestion of contaminated water, or by dermal contact with simazine.

### HEALTH EFFECTS [5]

#### Acute Toxicity

Simazine is slightly to practically non-toxic. The reported oral LD50 for technical simazine in rats and mice is >5000 mg/kg; its dermal LD50 is 3100 mg/kg in rats and > 10,000 mg/kg in rabbits. The 4-hour inhalation LC50 in rats is greater than 2 mg/L. The formulated products, in most cases, are less toxic via all routes. Simazine is non-irritating to the skin and eyes of rabbits except at high doses. Patch tests on humans have shown that simazine is not a skin irritant, fatiguing agent, or sensitiser. However, rashes and dermatitis from occupational exposure to simazine have occurred. The triazine herbicides disturb energy metabolism (thiamin and riboflavin functions). Symptoms include difficulty in walking, tremor, convulsions, paralysis, cyanosis, slowed respiration, miosis (pinpoint pupils), gut pain, diarrhoea, and impaired adrenal function. No cases of poisoning in humans have been reported from ingestion of simazine. Rats given an oral dose of 5000 mg/kg exhibited drowsiness and irregular breathing. In another study, a single oral dose of 4200 mg/kg produced anorexia, weight loss, and some deaths in rats within 4 to 10 days. For unknown reasons, sheep and cattle are especially susceptible to poisoning by simazine. Doses of 500 mg/kg were fatal in sheep with death delayed for 5 to 16 days. Symptoms exhibited by poisoned sheep included lower food intake, higher water intake, incoordination, tremors, and weakness, especially in the hindquarters.

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### Chronic Toxicity

Some 90-day feeding studies showed reduced body weight at 67 to 100 mg/kg/day. This same effect and kidney toxicity were seen in rats at doses of 150 mg/kg/day. In 2-year chronic oral feeding studies in which rats were given daily dosages of 5 mg/kg/day of simazine in the diet, no gross or microscopic signs of toxicity were seen. When rats were given repeated doses of 15 mg/kg/day, some liver cells degenerated during the first 3 days, but the condition did not progress. Instead, the liver adapted and the compound was metabolised. Other effects observed in test animals include tremors, damage to the testes, kidneys, liver, and thyroid, disturbances in sperm production, and gene mutations.

### Reproductive Effects

No adverse effects on reproductive capacity or development were observed in a three-generation study of rats fed 5 mg/kg/day simazine. High rates of fetotoxicity and decreased birth weight were noted in the fetuses of pregnant rabbits fed 75 mg/kg/day. Reproductive effects are not likely in humans under normal circumstances.

### Teratogenic Effects

No dose-related teratogenic effects were observed when rabbits were given daily doses of 5, 75, or 200 mg/kg for days 7 through 19 of pregnancy. Chronic inhalation of a cumulative dose of 0.3 mg/L for 8 days in pregnant rats resulted in no treatment-related developmental abnormalities. Simazine does not appear to be teratogenic.

### Mutagenic Effects

Simazine has shown negative results in a variety of mutagenicity tests on bacterial cultures. Tests on human lung cell cultures have produced both positive and negative results. When injected into adult male fruitflies, simazine increased the frequency of sex-linked lethal mutations, but failed to do so when fed to larvae. Other tests for mutagenicity in fruitflies were negative [3]. It is likely that simazine is either nonmutagenic or weakly mutagenic.

### Carcinogenic Effects

Simazine was not tumorigenic in mice at the maximum tolerated dose of 215 mg/kg/day over an 18-month period. In other studies, doses as low as 5 mg/kg/day produced excess tumours (thyroid and mammary) in female

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rats. Because of inconsistencies in the data, it is not possible to determine simazine's carcinogenic status.

### Organ Toxicity

Damage to the testes, kidneys, liver, and thyroid has been observed in test animals.

### **SAFETY [6]**

#### First Aid Measures

- Inhalation: Remove affected person to fresh air until recovered.
- Ingestion: If swallowed do NOT induce vomiting; seek medical advice immediately and show this container or label or contact the Poisons Information Centre on 13 11 26 (Aust). Make every effort to prevent vomit from entering the lungs by careful placement of the patient.
- Skin: Remove contaminated clothing and launder before re-use. Wash affected areas thoroughly with soap and water.
- Eye: If in eyes, hold eyelids open and wash with copious amounts of water for at least 15 minutes.
- First Aid Facilities: If poisoning occurs, contact a doctor or the Poisons Information Centre (Australia) on 13 11 26.

#### Fires & Explosion Information

- Suitable Extinguishing Media: Water, foam, carbon dioxide or dry chemical.
- Hazards from Combustion Products: Non-flammable. If involved in a fire, it will emit oxides of nitrogen, oxides of carbon and possibly hydrogen chloride.
- Special Protective Equipment for firefighters: Breathable air apparatus may have to be worn if material is involved in fires especially in confined spaces.
- Other Information: STOP FIRE WATER FROM ENTERING DRAINS OR WATER BODIES.

#### Exposure Controls & Personal Protection

##### Engineering Controls

- Handle in well ventilated areas, generally natural ventilation is adequate.

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### Protective Equipment

- Respiratory Protection: If dusts are present, wear a class P1 dust mask.
- Personal Protective Equipment: It is good practice to wear suitable personal protective equipment (PPE).
- When opening the container, preparing spray and using the prepared spray wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length PVC gloves and goggles.
- Re-entry period: Do not enter treated area until spray has dried.

### Hygiene Measures

- After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
- After each day's use, wash contaminated clothing and safety equipment.

## REGULATION

### United States [7]

#### Drinking Water Standards:

EPA: The Environmental Protection Agency has established the following drinking water guidelines for simazine:

- MCLG (maximum contaminant level goals): 0.004 mg/L
- MCL (maximum contaminant level): 0.004 mg/L
- HAL (health advisory level)(child): 1- to 10-day: 0.07 mg/L; Longer-term: 0.07 mg/L

#### Occupational Exposure Limits:

- No occupational exposure limits for simazine have been set by OSHA, NIOSH, or ACGIH

### Australia [9]

- Safe Work Australia has not set an exposure standard for simazine
- Australian Drinking Water Guidelines December 2013: Based on human health concerns, simazine in drinking water should not exceed 0.02 mg/L.

## REFERENCES

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## Gossip

## CHEMWATCH

### A 'silver bullet' for the chemical conversion of carbon dioxide

2019-06-05

Fossil fuels are the lifeblood of modern societies, but their increased use releases carbon dioxide, a climate-warming greenhouse gas, faster than plants can recycle it via photosynthesis. Now, a powerful combination of experiment and theory has revealed atomic-level details about how silver helps transform carbon dioxide gas into a reusable form. The results, reported in the journal *Nature Communications*, will help in the design of more efficient metal catalysts. "Before, people always thought that the process was the same on all metals," said Berkeley Lab researcher Yifan Ye, one of the study's authors. "But now, we have discovered that there are other options for reactions. This is new chemistry, and it's a new reaction pathway." Metals such as silver facilitate the transformation (or "reduction") of carbon dioxide into carbon monoxide (CO), which is used to synthesise other useful chemicals. The work revealed a surprising first step in this process that hadn't been seen nor suggested before. Ultimately, the researchers hope to optimise carbon dioxide catalysis by using additives or metal alloys.

Phys.org, 24 May 2019

<http://phys.org>

### Scientists develop new technology for extracting non-ferrous and noble metals

2019-06-05

Scientists at Russia's Ural Federal University (UrFU) are working on solving the problem of extracting non-ferrous and noble metals which are found in hard-to-process ores. Currently, there are many deposits where it is technically difficult to extract valuable components. This may be due to the presence of nanoscale gold and platinum group metals, their dissemination into the minerals' sulfide matrix, or the presence of such highly toxic compounds as arsenic or antimony in the ore. According to the project manager, senior researcher at the UrFU Academic Department of Nonferrous Metallurgy Denis Rogozhnikov, the relevance of the study is determined by the need to find new ways to process such refractory materials, as due to the depletion of ores rich in minerals and the deterioration of processed raw materials, currently, the existing technologies are not efficient or cost-effective from both economic and environmental points of view. "Even modern high-intensity methods, such

**Scientists discover a surprising first step in the chemical transformation of carbon dioxide using a silver catalyst.**

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as ultrafine ore grinding, bacterial leaching, high-temperature autoclave oxidation, do not always allow [us] to achieve acceptable rates for the extraction of non-ferrous and noble metals," Denis Rogozhnikov says. "In this regard, it is of particular importance to search for ways to open such resistant ores and to further isolate gold, silver or platinum metals in order to reduce their losses at various stages of the technological process." The goal of the research is to study the physicochemical patterns and mechanisms of nitric acid dissection of resistant sulfide minerals containing non-ferrous and noble metals. This will make it possible to complete the fundamental principles of the high-intensity hydrochemical process of developing such resistant materials contained in the processed raw materials of both Russian and global mining and metallurgical complexes. "We want to create an integrated technology for hydrometallurgical processing of such complex materials, carry out a project feasibility study, test it on a pilot scale and in the future build industrial enterprises to process these types of valuable raw materials based on nitric acid leaching," Denis Rogozhnikov emphasises. "In the course of the project, the fundamental task of developing a process for using the nitrous gases formed during leaching without their removal from the system in a closed cycle will be solved." From a scientific point of view, the results of studying surface phenomena at the solid-liquid interfaces are of great interest: the formation of intermediate product films, the thickness and continuity of films, proposals for eliminating their influence on the speed of the studied processes, and other determined kinetic characteristics. On the basis of the studies performed, development of mathematical models of the nitric acid leaching of the natural monosulfides in question is planned. These models will allow us to calculate the rates of the processes and the degree of dissection of the materials under consideration for given mineralogical compositions. In order to create new technologies, plans are underway to conduct research both on model monosulfides and on real production facilities. This will allow us to apply the research results in the real sector of the economy: metallurgical enterprises. "An extremely important advantage of the complex technology being developed is a prerequisite for obtaining environmentally friendly industrial waste, since in this case it is a question of processing raw materials containing highly toxic compounds, primarily arsenic," Denis Rogozhnikov notes. "[We take into account] the disposal and further long-term storage of waste in the form of the compounds which are insoluble, compact and not subject to the effects of natural atmospheric conditions. This provides another important advantage of the technology: the environmental factor." The scientists are confident that the involvement of refractory gold-bearing raw materials in processing

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will provide additional benefits from the sale of recoverable valuable products of precious metals. In turn, the processing of toxic components will help avoid fines imposed by environmental agencies, which have been constantly reinforcing the requirements for environmental control in recent years. The project, led by Denis Rogozhnikov, received a two-year presidential grant for the development of scientific research. The grant amounts to 600 thousand rubles a year. In addition, the project's research team will become part of the Research and Educational Centre "Advanced Industrial Technologies," created in the Urals region in the framework of the national project "Science."

Phys.org, 23 May 2019

<http://phys.org>

## We Just Generated Usable Electricity From Americium For The First Time

2019-06-05

For the first time, researchers have successfully generated electricity from americium, one of the radioactive elements we've pinned our hopes on as a promising alternative to rocket fuel, for powering farther and farther ventures out into space. It's a new milestone in experiments with the synthetic element, which doesn't occur naturally but is a by-product of plutonium decay. Americium can be found in spent nuclear fuel, but over time it also accumulates in stored plutonium as the latter element undergoes beta decay. Taking a small amount of americium, scientists were able to illuminate a single lightbulb in a specially shielded laboratory using heat produced by the element; but this tiny light could be a major first step. Their futuristic vision is that pellets made from the element could be used to send probes deeper into space, or to power planetary rovers that can't rely on traditional types of power such as solar. We already know that the longer spacecraft can stay powered up for, the more useful data they can send back, which makes the potential use of americium an exciting prospect. "It is great to think that americium can be used in this way, recycling something that is a waste from one industry into a significant asset in another," says one of the researchers, Tim Tinsley from the National Nuclear Laboratory (NNL) in the UK. "Seeing this lightbulb lit is the culmination of a huge amount of specialist technical work." Several years of technical work in fact, involving the NNL, the University of Leicester in the UK, commercial company European Thermodynamics, and the European Space Agency (ESA). While these organisations have been happy to announce the result, for now we'll have to be patient as

**For the first time, researchers have successfully generated electricity from americium, one of the radioactive elements we've pinned our hopes on as a promising alternative to rocket fuel, for powering farther and farther ventures out into space.**

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we wait for a paper outlining the details of the work. We do know that the plutonium involved was sourced from the UK's stockpile – originally stored as a potential alternative to uranium for nuclear power. "The americium in plutonium is potentially a problem for re-using the plutonium as new fuel," Adrian Bull from the NNL told World Nuclear News. "In extracting the americium from aged plutonium stocks, we end up with both the separated americium and also 'cleaner' plutonium – for potential re-use in the fuel cycle. So, it's a win-win." Getting to the stage of using americium in spacecraft is going to take more years of study and investment; some existing probes already use plutonium isotopes – and now scientists know it's possible to use americium in this way, too. If we're really going to start exploring the Universe in a serious way, we're going to need some revolutionary types of fuel – and some really big spaceships. With each passing year though, scientists are making progress. "Radioisotope power sources are an important technology for future European space exploration missions as their use would result in more capable spacecraft, and probes that can access distant, cold, dark and inhospitable environments," says one of the researchers, Richard Ambrosi from the University of Leicester. "This is an important step in achieving these goals." If space battery technologies like those involved in this americium experiment can be fully developed and used effectively, we might not have to say goodbye to our deep space probes quite as early in the future.

Science Alert, 1 June 2019

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

### Fungus with a venom gene could be new mosquito killer

2019-06-05

In the 1980s, the village of Soumouso in Burkina Faso helped launch one of the most powerful weapons against malaria: insecticide-treated bed nets, which had early field trials there and went on to save millions of lives. But as mosquitoes developed resistance to widely used insecticides, the nets lost some of their power. Now, researchers are hoping the village can help make history again by testing a new counter-measure: a genetically modified (GM) fungus that kills malaria-carrying mosquitoes. In tests in a 600-square-metre structure in Soumouso called the MosquitoSphere—built like greenhouse but with mosquito netting instead of glass—the fungus eliminated 99% of the mosquitoes within a month, scientists report in this issue of Science. "To be able to clear insecticide-resistant mosquitoes to this level is amazing," says entomologist Marit Farenhorst

**Researchers are testing a new counter-measure in the fight against mosquitoes: a genetically modified (GM) fungus.**

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of In2Care, a mosquito control company in Wageningen, the Netherlands. But Farenhorst, who was not involved in the study, emphasises that the fungus is a long way from real-world use. Because it is genetically modified to make it more lethal, it could face steep regulatory obstacles. The fungus also has clear advantages, however: It spares insects other than mosquitoes, and because it doesn't survive long in sunlight, it's unlikely to spread outside the building interiors where it would be applied. Fungi naturally infect a variety of insects, consuming the host's tissues in order to reproduce, and they have been used for decades to control a wide variety of crop pests. In 2005, researchers tested a fungus called *Metarhizium* in test huts in Tanzania and found that it killed malaria-transmitting mosquitoes. But it did so slowly, and many infected mosquitoes survived long enough to transmit malaria. It was also difficult to ensure mosquitoes picked up a lethal dose of spores. Since then, researchers have tested dozens of different fungal strains against disease-carrying mosquitoes, but none was effective enough to pass muster. So, researchers from the University of Maryland (UMD) in College Park and the Research Institute of Health Sciences & Centre Muraz in Bobo-Dioulasso, Burkina Faso, endowed a strain called *M. pingshaense* with a gene for a toxin isolated from spider venom that turns on when it contacts hemolymph, the insect version of blood. In the lab, the team showed its creation could kill mosquitoes faster and that just one or two spores could cause a lethal infection. "But it's hard to replicate the complexities of nature in the lab," says UMD entomologist Brian Lovett, who helped lead the study. Burkina Faso was a promising place for a field test: Unlike many countries in Africa, it has an established system to evaluate and approve the use of GM organisms. It also has one of the highest rates of malaria in the world, and insecticide-resistant mosquitoes are widespread. For those and other reasons, the U.S. National Institutes of Health funded the MosquitoSphere, which is specifically designed to test GM organisms. The researchers cooperated with local residents to collect insecticide-resistant larvae from shallow pools and raised them to adulthood inside the facility. After biting, the female mosquitoes prefer to rest on a dark-coloured surface, so the team mixed the fungus in locally produced sesame oil and spread the oil on black cotton sheets, which they hung in the sphere's test compartments. The team compared sheets treated with wild type fungus, the transgenic fungus, and oil without fungus. They released 500 female and 1000 male mosquitoes in each test compartment and gave the mosquitoes a calf to feed on for two nights every week. After two generations—45 days—there were as many as 2500 adult mosquitoes in the control compartment, roughly 700 in the compartment with wild type fungus, but only 13 in the compartment with the GM fungus. "It's an elegant study," Farenhorst

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says. However, she notes that receiving approval for a GM fungus will be time-consuming and expensive in many places, and anti-GM groups may object, as they do against malaria-resistant GM mosquitoes. "I'm not convinced that this is the way forward." But Gerry Killeen, a malaria expert at the Ifakara Health Institute in Dar es Salaam, Tanzania, says the transgenic fungus might have an advantage over those found in nature: If it could be patented, it could be easier to turn into a product worthwhile for a company to develop and market. "The greatest barrier to new malaria control tools isn't lack of technology or imagination, it's the lack of a market," he says. And because the transgenic fungus needs so few spores to cause a lethal infection, the product could be longer-lasting and less expensive than unmodified fungi. "If this technology has the potential to reduce costs and extend product lifetime simply by being more potent," Killeen says, "then bring it on."

Science, 30 May 2019

<http://sciencemag.org/>

### Flexible generators turn movement into energy

2019-06-05

Wearable devices that harvest energy from movement are not a new idea, but a material created at Rice University may make them more practical. The Rice lab of chemist James Tour has adapted laser-induced graphene (LIG) into small, metal-free devices that generate electricity. Like rubbing a balloon on hair, putting LIG composites in contact with other surfaces produces static electricity that can be used to power devices. For that, thank the triboelectric effect, by which materials gather a charge through contact. When they are put together and then pulled apart, surface charges build up that can be channelled toward power generation. In experiments, the researchers connected a folded strip of LIG to a string of light-emitting diodes and found that tapping the strip produced enough energy to make them flash. A larger piece of LIG embedded within a flip-flop let a wearer generate energy with every step, as the graphene composite's repeated contact with skin produced a current to charge a small capacitor. "This could be a way to recharge small devices just by using the excess energy of heel strikes during walking, or swinging arm movements against the torso," Tour said. The project is detailed in the American Chemical Society journal ACS Nano. LIG is a graphene foam produced when chemicals are heated on the surface of a polymer or other material with a laser, leaving only interconnected flakes of two-dimensional carbon. The lab first made LIG on common

**Researchers have produced triboelectric nanogenerators with laser-induced graphene. The flexible devices turn movement into electrical energy and could enable wearable, self-powered sensors and devices.**

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polyimide, but extended the technique to plants, food, treated paper and wood. The lab turned polyimide, cork and other materials into LIG electrodes to see how well they produced energy and stood up to wear and tear. They got the best results from materials on the opposite ends of the triboelectric series, which quantifies their ability to generate static charge by contact electrification. In the folding configuration, LIG from the tribo-negative polyimide was sprayed with a protecting coating of polyurethane, which also served as a tribo-positive material. When the electrodes were brought together, electrons transferred to the polyimide from the polyurethane. Subsequent contact and separation drove charges that could be stored through an external circuit to rebalance the built-up static charge. The folding LIG generated about 1 kilovolt, and remained stable after 5,000 bending cycles. The best configuration, with electrodes of the polyimide-LIG composite and aluminium, produced voltages above 3.5 kilovolts with a peak power of more than 8 milliwatts. "The nanogenerator embedded within a flip-flop was able to store 0.22 millijoules of electrical energy on a capacitor after a 1-kilometre walk," said Rice postdoctoral researcher Michael Stanford, lead author of the paper. "This rate of energy storage is enough to power wearable sensors and electronics with human movement." Co-authors of the paper are Rice graduate students Yieu Chyan and Zhe Wang and undergraduate students John Li and Winston Wang. Tour is the T.T. and W.F. Chao Chair in Chemistry as well as a professor of computer science and of materials science and nanoengineering at Rice. The Air Force Office of Scientific Research supported the research.

Science Daily, 31 May 2019

<http://www.sciencedaily.com>

## New compound which kills antibiotic-resistant superbugs discovered

2019-06-05

A new compound which visualises and kills antibiotic resistant superbugs has been discovered by scientists at the University of Sheffield and Rutherford Appleton Laboratory (RAL). The team, led by Professor Jim Thomas, from the University of Sheffield's Department of Chemistry, is testing new compounds developed by his PhD student Kirsty Smitten on antibiotic resistant gram-negative bacteria, including pathogenic *E. coli*. Gram-negative bacteria strains can cause infections including pneumonia, urinary tract infections and bloodstream infections. They are difficult to treat as the cell wall of the bacteria prevents drugs from

**A new compound has killed antibiotic resistant gram-negative bacteria, including *E. coli*, during tests.**

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getting into the microbe. Antimicrobial resistance is already responsible for 25,000 deaths in the EU each year, and unless this rapidly emerging threat is addressed, it's estimated by 2050 more than 10 million people could die every year due to antibiotic resistant infections. Doctors have not had a new treatment for gram-negative bacteria in the last 50 years, and no potential drugs have entered clinical trials since 2010. The new drug compound has a range of exciting opportunities. As Professor Jim Thomas explains: "As the compound is luminescent it glows when exposed to light. This means the uptake and effect on bacteria can be followed by the advanced microscope techniques available at RAL." "This breakthrough could lead to vital new treatments to life-threatening superbugs and the growing risk posed by antimicrobial resistance." The studies at Sheffield and RAL have shown the compound seems to have several modes of action, making it more difficult for resistance to emerge in the bacteria. The next step of the research will be to test it against other multi-resistant bacteria. In a recent report on antimicrobial resistant pathogens, the World Health Organisation put several gram-negative bacteria at the top of its list, stating that new treatments for these bacteria were 'Priority 1 Critical' because they cause infections with high death rates, are rapidly becoming resistant to all present treatments and are often picked up in hospitals. The research, published in the journal ACS Nano, describes the new compound which kills gram-negative E. coli, including a multidrug resistant pathogen said to be responsible for millions of antibiotic resistant infections worldwide annually.

Science Daily, 28 May 2019

<http://www.sciencedaily.com>

## For Nanomaterial Safety, Grab A Bucket And Trash Bags

2019-06-05

Keeping nanomaterials in their place is possible with some practice, plus about 10 minutes, a couple of bags, and a big bucket. The Rice University lab of chemist Andrew Barron works with bulk carbon nanotubes on a variety of projects. Years ago, members of the lab became concerned that nanotubes could escape into the air, and developed a cheap and clean method to keep them contained as they transferred them from large containers into jars for experimental use. More recently Barron himself became concerned that too few labs around the world were employing best practices to handle nanomaterials. He decided to share what his team had learned. "There was a series of studies that said if you're going to handle nanotubes, you really need to use safety protocols," Barron says.

**Keeping nanomaterials in their place is possible with some practice, plus about 10 minutes, a couple of bags, and a big bucket.**

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"Then I saw a study that said many labs didn't use any form of hood or containment system. In the US, it was really bad, and in Asia it was even worse. But there are a significant number of labs scaling up to use these materials at the kilogram scale without taking the proper precautions." The lab's inexpensive method appears in an open-access paper in *SN Applied Sciences*. In bulk form, carbon nanotubes are fluffy and disperse easily if disturbed. The Rice lab typically stores the tubes in five-gallon plastic buckets, and simply opening the lid is enough to send them flying because of their low density. Varun Shenoy Gangoli, a research scientist in Barron's lab, and Pavan Raja, a scientist with Rice's Nanotechnology-Enabled Water Treatment centre, developed for their own use a method that involves protecting the worker and sequestering loose tubes when removing smaller amounts of the material for use in experiments. Full details are available in the paper, but the precautions include making sure workers are properly attired with long pants, long sleeves, lab coats, full goggles, and face masks, along with two pairs of gloves duct-taped to the lab coat sleeves. The improvised glove bag involves a 25-gallon trash bin with a plastic bag taped to the rim. The unopened storage container is placed inside, and then the bin is covered with another transparent trash bag, with small holes cut in the top for access. After transferring the nanotubes, acetone wipes clean the gloves and more acetone is sprayed inside the barrel so settling nanotubes would stick to the surfaces. It's possible to recover them and return them to the storage container. Barron says it took lab members time to learn to use the protocol efficiently, "but now they can get their samples in 5 to 10 minutes." He's sure other labs can and will enhance the technique for their own circumstances. He notes a poster by Gangoli presented at the Ninth Guadalupe Workshop on the proper handling of carbon nanotubes that garnered recognition and discussion among researchers in the field, noting the importance of the work for agencies in general. "I think this is something people will use," says Barron, professor emeritus of chemistry at Rice and the Sêr Cymru Chair of Low Carbon Energy and Environment at Swansea University, Wales. "There's nothing outrageous but it helps everybody, from high schools and colleges that are starting to use nanoparticles for experiments to small companies." That was the goal: Let's provide a process that doesn't cost thousands of dollars to install and allows you to transfer nanomaterials safely and on a large scale. Finally, publish said work in an open-access journal to maximise the reach across the globe." Funding for the work

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came via the Robert A. Welch Foundation, the Office of Naval Research, and the Welsh government through the Sêr Cymru Chair Program.

Futurity, 3 June 2019

<http://www.futurity.org>

### Research group finds way to turn plastic waste products into jet fuel

2019-06-05

A research group led by Washington State University scientists has found a way to turn daily plastic waste products into jet fuel. In a new paper published in the journal *Applied Energy*, WSU's Hanwu Lei and colleagues melted plastic waste at high temperature with activated carbon, a processed carbon with increased surface area, to produce jet fuel. "Waste plastic is a huge problem worldwide," said Lei, an associate professor in WSU's Department of Biological System Engineering. "This is a very good, and relatively simple, way to recycle these plastics."

#### How it works

In the experiment, Lei and colleagues tested low-density polyethylene and mixed a variety of waste plastic products, like water bottles, milk bottles, and plastic bags, and ground them down to around three millimetres, or about the size of a grain of rice. The plastic granules were then placed on top of activated carbon in a tube reactor at a high temperature, ranging from 430 degree Celsius to 571 degrees Celsius. That's 806 to 1,060 Fahrenheit. The carbon is a catalyst, or a substance that speeds up a chemical reaction without being consumed by the reaction. "Plastic is hard to break down," Lei said. "You have to add a catalyst to help break the chemical bonds. There is a lot of hydrogen in plastics, which is a key component in fuel." Once the carbon catalyst has done its work, it can be separated out and re-used on the next batch of waste plastic conversion. The catalyst can also be regenerated after losing its activity. After testing several different catalysts at different temperatures, the best result they had produced a mixture of 85 percent jet fuel and 15 percent diesel fuel.

#### Environmental impact

According to the Environmental Protection Agency, landfills in the U.S. received 26 million tons of plastic in 2015, the most recent year statistics are available. China has recently stopped accepting plastic recycling from the U.S. and Canada. Conservative estimates by scientists say that at least

**A research group led by Washington State University scientists has found a way to turn daily plastic waste products into jet fuel.**

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4.8 million tons of plastic enters the ocean each year worldwide. Not only would this new process reduce that waste, very little of what is produced is wasted. "We can recover almost 100 percent of the energy from the plastic we tested," Lei said. "The fuel is very good quality, and the by-product gasses produced are high quality and useful as well." He also said the method for this process is easily scalable. It could work at a large facility or even on farms, where farmers could turn plastic waste into diesel. "You have to separate the resulting product to get jet fuel," Lei said. "If you don't separate it, then it's all diesel fuel."

Phys.org, 3 June 2019

<http://phys.org>

### Energy storage project in Utah described as world's largest of its kind

2019-06-05

Mitsubishi Hitachi Power Systems (MHPS) announced an ambitious energy storage project to develop what it claims will be the world's largest energy storage project of its kind, in Utah. Renewable hydrogen is at the core. The project is dubbed "Advanced Clean Energy Storage" (ACES). MHPS developed gas turbine technology that enables a mixture of renewable hydrogen and natural gas to produce power with lower carbon emissions. John Parnell in Forbes said their gas turbine for power plants "can operate efficiently with a mixture of natural gas and hydrogen." He said that MHPS sketched out a technology roadmap that will eventually see a gas turbine using exclusively hydrogen. MHPS is a global leader for heavy-duty gas turbines. The company said it will initially develop enough storage to serve the needs of 150,000 households for an entire year. MHPS is not the only driver in this project, however. They are joined by Magnum Development. Magnum has below-ground technologies to store energy at utility scale. According to POWER, the Magnum Salt Dome is a geologic formation tectonically developed from a bedded salt deposit. Seismic mapping suggests it measures "at least one mile thick and about three miles wide." The news release said Magnum controls the only known 'Gulf Coast' style domal-quality salt formation in the western United States. The release said five salt caverns were in operation for liquid fuels storage. The plan: to develop 1,000 megawatts of 100 percent clean energy storage. That number was as per the MHPS press release. In an article by Sonal Patel in POWER, the author focused on clarifying what that 1,000 MW of renewable power actually represents. The project could store up 1,000 MW of renewable energy year-round. It could be provided to "variability-

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challenged" Western power markets. Patel also said that, responding to a request for clarification about the 1,000-MW figure attributed to the facility, which will comprise both storage and power generation, "MHPS said on May 31 ACES is still in the project scoping phase, and that the next step, which entails securing off-taker agreements for power, would determine the mix between renewable hydrogen, CAES, solid oxide fuel cells (SOFC), and flow batteries." So, renewable hydrogen is not the only technology on tap. Three others are involved to serve the needs of 150,000 households for a year. The ACES initiative will deploy a total of four types of clean energy storage at utility scale. Joining renewable hydrogen are compressed air energy storage; large-scale flow batteries; and solid oxide fuel cells. John Parnell in Forbes had more to say about the flow batteries. "The proposed Utah site will also feature flow batteries or flow machines as they are sometimes referred to. They behave like a battery but have longer discharge periods than lithium-based tech making them ideal for tasks beyond tweaking the grid." "The technologies we are deploying will store electricity on time scales from seconds to seasons of the year," said Paul Browning, President and CEO of MHPS Americas. Projects and proposals for energy storage are generally important topics. Forbes reminds readers of its benefits, for example, in the way that power can be pumped back into the grid at specific frequencies "to address any deviation from the optimal frequency," and its ability to limit the price impact of sudden peaks in demand on the network. MIT Technology Review commented that "Finding ways to add vast amounts of cheap energy storage to electricity grids is crucial if clean but erratic renewable sources like wind and solar are to produce a growing share of total generation." The project would be relying on hydrogen and compressed air stored deep underground. James Temple, senior editor for energy, MIT Technology Review, wrote that "Some energy observers raised questions about the project's viability, given the current economics of these technologies, neither of which is in wide use as a grid storage option." Temple further said that "A growing number of researchers do believe hydrogen could eventually play an important role in grid-scale energy storage. The hope is that cheap surplus renewable electricity can be used to drive an 'electrolysis' process that splits water into oxygen and hydrogen. But currently, electrolyzers are quite expensive and hydrogen can be difficult to transport, among other challenges."

Phys.org, 3 June 2019

<http://phys.org>

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### Most detailed X-ray image of batteries yet to reveal why they still aren't good enough

2019-06-05

Electric cars rely on the same lithium-ion battery technology that's in smartphones, laptops and virtually everything electronic. But the technology has been extremely slow to improve. While electric cars can more than handle the average American's daily commute, the average gas-powered car can still go farther on a full tank of gas, charging stations are scarce and it takes significantly longer to charge a battery than to fill a tank. To improve charging capacity in lithium-ion batteries and increase adoption of electric cars, the industry will have to return to the basic science of how batteries wear out over time. A multi-institute team of researchers has developed the most comprehensive view yet of lithium-ion battery electrodes, where most damage typically occurs from charging them repeatedly. Manufacturers could use this information to design batteries for your smartphone or car that are both more reliable and longer-lasting, the researchers say. "The creation of knowledge is sometimes more valuable than solving the problem of battery electrode damage," said Kejie Zhao, an assistant professor of mechanical engineering at Purdue University. "Before, people didn't have the techniques or theory to understand this problem." The technique, explained in the journals *Advanced Energy Materials* and the *Journal of the Mechanics and Physics of Solids*, is essentially an X-ray tool driven by artificial intelligence. It can automatically scan thousands of particles in a lithium-ion battery electrode at once - all the way down to the atoms that make up the particles themselves - using machine-learning algorithms. Granted, there are actually millions of particles in a battery electrode. But researchers can now analyse them more thoroughly than they could before - and at the various operating conditions that we use commercial batteries in the real world, such as their voltage window and how quickly they charge. "Most work had been focused on the single particle level and using that analysis to understand the whole battery. But there's obviously a gap there; a lot differs between a single particle at a micron scale and the whole battery at a much larger scale," said Zhao, whose lab studies the fundamental science of how the mechanical and electrochemical aspects of a battery affect each other. Every time that a battery charges, lithium ions travel back and forth between a positive electrode and a negative electrode. These ions interact with particles in electrodes, causing them to crack and degrade over time. Electrode damage reduces a battery's charging capacity. It's hard for a battery to have a high capacity and be reliable at the same time, Zhao says. Increasing a battery's capacity often means sacrificing

**A multi-institute team of researchers has developed the most comprehensive view yet of lithium-ion battery electrodes, where most damage typically occurs from charging them repeatedly.**

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its reliability. The researchers' work to map out damage in lithium-ion batteries started with their finding that degradation in battery particles doesn't happen at the same time or in the same location; some particles fail more quickly than others. But to truly study this in more detail, the team needed to create a new technique altogether; existing methods wouldn't entirely capture damage in battery electrodes. A YouTube video is available at <https://www.youtube.com/watch?v=cdskb57St8s>.

The researchers turned to massive, miles-long facilities called synchrotrons at the European Synchrotron Radiation Facility (ESRF) and the Stanford Synchrotron Radiation Lightsource (SSRL) of SLAC National Laboratory. These facilities host particles traveling at almost the speed of light, giving off radiation that is used to create images called synchrotron X-rays. Virginia Tech researchers manufactured the materials and batteries for testing - ranging from the pouch cell batteries in smartphones to the coin cells in watches. Researchers at ESRF and SSRL created the ability to scan as many electrode particles in these batteries as possible in a single go, then produce these X-ray images for analysis. Maps of particle cracking and degradation at the surfaces of particles, called "interfacial debonding," can now serve as a reference tools for knowing ranging degrees of damage in battery electrodes. To understand how these cracks impact battery performance, Zhao's team at Purdue developed theories and computational tools. They found, for example, that because particles near where lithium ions shuttle back and forth, called the "separator," are more used than particles near the bottom of electrode materials, they fail more quickly. This variability in electrode particle damage, or "heterogeneous degradation," is more severe in thicker electrodes and during fast-charging conditions. "The capacity of batteries doesn't depend on how many particles are in the battery; what matters is how the lithium ions are used," Zhao said. The goal for the project is not for every researcher and industry player to use the technique itself - especially given that there are only a handful of synchrotrons in the U.S. - but for these groups to use the knowledge generated from the technique. The researchers plan to continue using the technique to document how damage happens and affects performance in commercial batteries.

EurekAlert, 3 June 2019

<http://www.eurekalert.org>

### **Sensitive new laser technique detects volatile organic compounds**

2019-06-05

Researchers have developed a new way of operating miniature quantum cascade lasers (QCLs) to rapidly measure the absorption spectra of different organic molecules in the air simultaneously. The technique offers a sensitive method for detecting low concentrations of volatile organic compounds (VOCs), improving the ability to track how these compounds affect human health, industrial processes and ambient air quality. The new system also could improve the reliability of breath alcohol tests by more selectively distinguishing between ethanol and the other gases people exhale. QCLs are made from multiple layers of semiconductors arranged to boost photon emissions by exploiting quantum effects. The researchers designed a QCL based setup that measures compounds absorbing electromagnetic radiation across a wide spectrum with a single laser, a task that would have previously required multiple lasers working together. VOCs are commonly found in vehicle exhaust, solvents, building materials and many other products. They can be harmful to people and ecosystems, and they contribute to tropospheric ozone production and to global warming. Real-time methods to identify and track VOCs are important for pollution and climate researchers, public health organisations, manufacturers, first responders and shippers, among others. The new system, based on an electrically tunable infrared laser with no mechanical parts, provides sufficient precision and scans a wide enough range of optical frequencies to simultaneously identify several species that are present and determine their concentrations. The Switzerland-based researchers, led by Lukas Emmenegger of Empa, a materials science and technology institute, will describe their novel method at The Optical Society's Optical Sensors and Sensing Congress, which will take place from 25-27 June in San Jose, Calif., during Sensors Expo 2019.

#### Opening narrow windows onto a broad spectrum

Unlike the task of detecting a single chemical compound, identifying the different species within VOCs requires dialling the QCL's optical output across a very broad range of frequencies. To accomplish this, the researchers used a relatively new type of QCL, optimised to be adjustable across a wider than usual emission frequency range, known as a Very Large Tuning QCL (QC-XT), and powered the device in an intermittent mode to maximise optical tuning and minimise the laser's energy consumption. Then they introduced the main innovation of the new approach: By heating the front or back mirror of the laser with short pulses of electrical

**Accurate measurements of mixed airborne molecules could improve breath alcohol tests, climate research and sensors for occupational health and safety**

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current, they found they could select the span of frequencies the laser would produce by the so-called Vernier effect. Using this approach, the setup essentially moves through several channels of observation along the molecule's absorption spectrum in which precise details can be measured and compared to known spectral features, offering nearly continuous coverage across a wide frequency range with great precision. "The rapid switching between different channels of the QCL offers unprecedented real-time selectivity and sensitivity for the detection of VOCs," Emmenegger said. "High-precision VOC measurements are currently dominated by classical methods, such as gas chromatography or mass spectrometry. Combining the high spectral resolution of well-established distributed-feedback QCLs with the multi-channel capacity of QC-XT may become a game-changer in the field of VOC analysis," Emmenegger added.

#### Fast and sensitive detection

This innovative analytical approach lends itself particularly well to quick recognition of broadly spaced spectral features of VOCs. To test the method, the team used their new setup to simultaneously measure the infrared spectra of a mixture of methanol, ethanol and acetaldehyde. The demonstration showed that the method successfully distinguishes each molecular species from the others and is fast and sensitive. A round of measurements through six different spectral channels took a total of 18 milliseconds. While individual channels are scanned at very high spectral resolution within only 50 microseconds, most of the time is spent on adjusting the electrical heating of the laser components to select the next channel location along the spectra. The system assessed molecular concentrations as low as 50 parts per million with a precision of 50 parts per billion. With further work, the researchers believe the system could achieve even greater sensitivity.

#### Improving breath analysis

In addition to being primed for an array of applications in environmental and occupational VOC detection, the new system could find application in medical breath analysis or to improve currently employed standards for the measurement of breath alcohol content. In a paper published on 12 February in The Optical Society's journal Optics Express, the Empa team reports detection of airborne alcohol at concentrations as low as 9 parts per billion using a QCL. These results suggest that use of QCL laser-based spectrometers for breath alcohol analysis may offer a route to globally

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improved reliability and standardisation of the world's most frequent forensic test, researchers say.

EurekAlert, 3 June 2019

<http://www.eurekalert.org>

### Research team develops bioinks to print therapeutics in 3-D

2019-06-05

3-D bioprinting is emerging as a promising method for rapidly fabricating cell-containing constructs for designing new, healthy, functional tissues. However, one of the major challenges in 3-D bioprinting is lack of control over cellular functions. Growth factors, which are a special class of proteins, can direct cellular fate and functions. However, these growth factors cannot be easily incorporated within a 3-D-printed structure for a prolonged duration. In a recent study conducted at Texas A&M, researchers in Dr. Akhilesh K Gaharwar's lab in the Department of Biomedical Engineering formulated a bioink consisting of 2-D mineral nanoparticles to sequester and 3-D print therapeutics at precise locations. Their findings were published in *Advanced Healthcare Materials*. The team has designed a new class of hydrogel bioinks—3-D structures that can absorb and retain considerable amounts of water—loaded with therapeutic proteins. This bioink is made from an inert polymer, polyethylene glycol (PEG), and is advantageous for tissue engineering because it does not provoke the immune system. However, due to low viscosity of the PEG polymer solution, it is difficult to 3-D print this type of polymer. To overcome this limitation, the team has found that combining PEG polymers with nanoparticles leads to an interesting class of bioink hydrogels that can support cell growth and may have enhanced printability compared to polymer hydrogels by themselves. This new technology, based on a nanoclay platform developed by Gaharwar, assistant professor, can be used for precise deposition of protein therapeutics. This bioink formulation has unique shear-thinning properties that allow the material to be injected, quickly stop flowing and then cure to stay in place, which is highly desirable for 3-D bioprinting applications. "This formulation using nanoclay sequesters the therapeutic of interest for increased cell activity and proliferation," said Dr. Charles W. Peak, senior author on the study. "In addition, the prolonged delivery of the bioactive therapeutic could improve cell migration within 3-D printed scaffolds and can help in rapid vascularisation of scaffolds." Gaharwar said the prolonged delivery of the therapeutic could also reduce overall costs by decreasing

**A team of researchers at Texas A&M University has developed an innovative way to print therapeutics in 3-D for regenerative medicine.**

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the therapeutic concentration as well as minimising the negative side effects associated with supraphysiological doses. "Overall, this study provides proof of principle to print protein therapeutics in 3-D that can be used to control and direct cell functions," he said.

Phys.org, 3 June 2019

<http://phys.org>

### Researchers can now predict properties of disordered polymers

2019-06-05

Thanks to a team of researchers from the University of Illinois at Urbana-Champaign and the University of Massachusetts Amherst, scientists are able to read patterns on long chains of molecules to understand and predict behaviour of disordered strands of proteins and polymers. The results could, among other things, pave the way to develop new materials from synthetic polymers. The lab of Charles Sing, assistant professor of chemical and biomolecular engineering at Illinois, provided the theory behind the discovery, which was then verified through experiments conducted in the lab of Sarah Perry, assistant professor of chemical engineering at UMass Amherst, and Illinois alumna. The collaborators detailed their findings in a paper titled "Designing Electrostatic Interactions via Polyelectrolyte Monomer Sequence" published in ACS (American Chemical Society) Central Science. The colleagues set out to understand the physics behind the precise sequence of charged monomers along the chain and how it affects the polymer's ability to create self-assembling liquid materials called complex coacervates. "The thing that I think is exciting about this work is that we're taking inspiration from a biological system," Sing said. "The typical picture of a protein shows that it folds into a very precise structure. This system, however, is based around intrinsically disordered proteins." This paper builds on earlier findings from Perry and Sing from 2017, which ultimately aims to help advance smart material design. "Our earlier paper showed that these sequences matter, this one shows why they matter," Sing explained. "The first showed that different sequences give different properties in complex coacervation. What we're able to now do is use a theory to actually predict why they behave this way." Unlike structured proteins, which interact with very specific binding partners, most synthetic polymers do not. "They are fuzzier in that they will react with a wide range of molecules in their surroundings," Sing explained. They found that despite this fact, the precise sequence of the monomers along a protein

**Thanks to a team of researchers from the University of Illinois at Urbana-Champaign and the University of Massachusetts Amherst, scientists are able to read patterns on long chains of molecules to understand and predict behaviour of disordered strands of proteins and polymers.**

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(the amino acids) really does make a difference. "It has been obvious to biophysicists that sequence makes a big difference if they are forming a very precise structure," Sing said. "As it turns out, it also makes a big difference if they are forming imprecise structures." Even unstructured proteins have a precision associated with them. Monomers, the building blocks of complex molecules, are the links to the chain. What Sing's group theorised is that by knowing the sequence of polymers and monomers and the charge (positive, negative or neutral) associated with them, one can predict the physical properties of the complex molecules. "While researchers have known that if they put different charges different places in one of these intrinsically disordered proteins, the actual thermodynamic properties change," Sing said. "What we are able to show is that you can actually change the strength of this by changing it on the sequence very specifically. There are cases here that by changing the sequence by just a single monomer (a single link in that chain), it can drastically change how these things are able to form. We have also proven that we can predict the outcome." Sing adds that this information is valuable to biophysicists, bioengineers and material scientists alike. This discovery will help engineers understand a broad class of proteins and tune proteins to modify their behaviour. It gives them a new way to put information into molecules for building new materials and make a better guess as to how these properties behave. Materials scientists can, for example, use this information to have a level of control over a material to cause it to assemble into very complicated structures or make membranes that precisely filter out contaminants in water. Their hope is that scientists, inspired by biopolymers, can take this ability to predict the physical behaviours simply by reading the sequence to ultimately design new smart materials this way. "This in some sense is bringing biology and synthetic polymers closer together," Sing said. "For example, at the end of the day, there is not a major difference in the chemistry between proteins and nylon. Biology is using that information to instruct how life happens. If you can put in the identify of these various links specifically, that's valuable information for a number of other applications."

Phys.org, 3 June 2019

<http://phys.org>

**New research got creative and correlated data from a NASA research plane and orbiting satellites to devise a new way to determine hydroxyl radical levels worldwide.**

### New method to gauge atmosphere's ability to clear methane

2019-06-05

New research by UMBC's Glenn Wolfe and collaborators is shaping how scientists understand the fate of methane, a potent greenhouse gas, in Earth's atmosphere. Of the greenhouse gases, methane has the third greatest overall effect on climate after carbon dioxide and water vapor. And the longer it stays in the atmosphere, the more heat it traps. That's why it's essential for climate models to properly represent how long methane lasts before it's broken down. That happens when a methane molecule reacts with a hydroxyl radical -- an oxygen atom bound to a hydrogen atom, represented as OH -- in a process called oxidation. Hydroxyl radicals also destroy other hazardous air pollutants. "OH is really the most central oxidising agent in the lower atmosphere. It controls the lifetime of nearly every reactive gas," explains Wolfe, an assistant research professor at UMBC's Joint Centre for Earth Systems Technology. However, "globally, we don't have a way to directly measure OH." More than that, it's well understood that current climate models struggle to accurately simulate OH. With existing methods, scientists can infer OH at a coarse scale, but there is scant information on the where, when, and why of variations in OH. New research published in Proceedings of the National Academy of Sciences and led by Wolfe puts scientists on the path to changing that. Wolfe and colleagues have developed a unique way to infer how global OH concentrations vary over time and in different regions. Better understanding of OH levels can help scientists understand how much of the ups and downs in global methane levels are due to changing emissions, such as from oil and natural gas production or wetlands, versus being caused by changing levels of OH.

#### A flying laboratory

NASA satellites have been measuring atmospheric formaldehyde concentrations for over 15 years. Wolfe's new research relies on that data, plus new observations collected during NASA's recent Atmospheric Tomography (ATom) mission. ATom has flown four around-the-world circuits, sampling air with the aid of a NASA research aircraft. This "flying laboratory," as Wolfe describes it, collected data on atmospheric formaldehyde and OH levels that illustrates a remarkably simple relationship between the two gases. This did not surprise the scientists, because formaldehyde is a major by-product of methane oxidation, but this study provides the first concrete observation of the correlation between formaldehyde and OH. The findings also showed that the

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formaldehyde concentrations the plane measured are consistent with those measured by the satellites. That will allow Wolfe's team and others to use existing satellite data to infer OH levels throughout most of the atmosphere. "So, the airborne measurements give you a ground truth that that relationship exists," Wolfe says, "and the satellite measurements let you extend that relationship around the whole globe." Wolfe, however, is the first to acknowledge that the work to improve global models is far from done. The airplane measured OH and formaldehyde levels over the open ocean, where the air chemistry is relatively simple. It would be more complicated over a forest, and even more so over a city. While the relationship the researchers determined provides a solid baseline, as most of Earth's air does, indeed, float above oceans, more work is needed to see how OH levels differ in more complex environments. Potentially, different data from existing NASA satellites, such as those tracking emissions from urban areas or wildfires, could help. Wolfe hopes to keep refining this work, which he says is at "the nexus of the chemistry and climate research communities. And they're very interested in getting OH right."

#### Getting it right

The current study did consider seasonal variations in OH, by analysing measurements taken in February and August. "The seasonality is one aspect of this study that's important," Wolfe says, "because the latitude where OH is at its maximum moves around." Considering seasonal shifts in OH concentrations, or even multi-year shifts caused by phenomena like El Niño and La Niña, could be one angle to explore when trying to improve global climate models. Looking further at OH levels on a global scale using satellite data validated by airplane data could also help scientists refine their models. "You can use the spatial variability and the seasonality to understand at the process level what's driving OH, and then ask if the model gets that right or not," Wolfe says. "The idea is to be able to poke at all these features, where we haven't really had any data to do that with before." This new research is one step in the journey to enhancing our understanding of the global climate, even as it is rapidly changing. More accurately understanding how, for example, cutting methane emissions would affect the climate, and how quickly, could even influence policy decisions. "It's not perfect. It needs work," Wolfe says. "But the potential is there."

Science Daily, 3 June 2019

<http://www.sciencedaily.com>

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### Chemical blends as possible alternative refrigerants identified

2019-06-05

More than a dozen chemical blends could serve as alternative refrigerants that won't heat the atmosphere as much as today's refrigerants do, or catch fire, according to a new computational study by the National Institute of Standards and Technology (NIST). The NIST study identified the 22 "best" non-flammable or marginally flammable blends with lower global warming potential (GWP) -- a measure of how much heat a gas will trap if released into the atmosphere -- than the current standard refrigerant for vehicle air conditioning (AC), called R-134a (tetrafluoroethane). Most of the identified blends combine R-134a with one or two other commercial refrigerants. The new NIST analysis, which was conducted for the U.S. military but also applies to civilian applications such as AC systems for homes and cars, is a follow-up to a 2017 NIST study that found that all single-component, climate-friendly refrigerants were at least marginally flammable. That study suggested blends might offer the optimal solutions. "The military is insistent about wanting non-flammable blends, but the civilian applications are moving more and more toward at least marginally flammable mixtures," NIST mechanical engineer and study lead author Ian Bell said. To help reduce global warming, nearly 200 nations, including the United States, agreed in 2016 to amend the Montreal Protocol to phase down by mid-century the refrigerants used in most AC systems. The partial phasedown, rather than a complete phase-out, recognised the complicated choices that will need to be made to select replacements. For the new study, NIST researchers selected 13 fluids within a range of pressure, flammability, and GWP values that might produce a blend with the desired characteristics. All fluids were low in toxicity and commercially available. The researchers conducted an extensive evaluation of all possible combinations of two or three of the 13 fluids. The fluids included hydrofluoroolefins, which have very low GWP but are mildly flammable; non-flammable hydrofluorocarbons (HFCs) with moderate-to-high GWP; mildly flammable HFCs; and carbon dioxide, which is non-flammable and also has a very low GWP of 1, but would raise the operating pressure of a blend, which is undesirable. NIST researchers did not find any blends that met all desired constraints -- nonflammability, low GWP, high efficiency (cooling per unit of work), and overall cooling capacity similar to that of the R-134a baseline system. The study identified 14 non-flammable blends that offered a reduction in GWP of, at most, 51 percent compared to R-134a's GWP of 1300. An additional eight blends that were marginally flammable were identified with GWP reductions of as

**More than a dozen chemical blends could serve as alternative refrigerants that won't heat the atmosphere as much as today's refrigerants do, or catch fire, according to a new computational study.**

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much as 99 percent. Researchers simulated the performance of these 22 blends in a detailed refrigeration cycle model. The study was performed using computational tools; researchers plan to carry out laboratory experiments to verify the results. The study revealed several trends. The most promising non-flammable blends have slightly lower efficiency compared to R-134a. These non-flammable blends have a lower GWP limit of 640; this is due to the need for a lot of R-134a in the mixture to suppress the flammability of low-GWP fluids. Other blends containing a significant amount of carbon dioxide were also non-flammable, but these had very low efficiencies compared to R-134a and were not considered viable alternatives. There is also a general trend of efficiency increasing in tandem with GWP and flammability. This is because lower-GWP fluids tend to be more complex molecules and this complexity can hinder refrigeration performance. "The 'good' blends that we found are very borderline non-flammable," Bell cautioned. "That doesn't mean that they won't still burn given the right environment. We need to be cautious, because this is sort of a dark art. There is a fundamental trade-off: If you really want nonflammability and efficiency, you won't get both. You will get one or the other."

Science Daily, 29 May 2019

<http://www.sciencedaily.com>

### **New path to capturing and upgrading carbon dioxide**

2019-06-05

A research team from U of T Engineering has developed a new electrochemical path to transform CO<sub>2</sub> into valuable products such as jet fuel or plastics. The technology could significantly improve the economics of capturing and recycling carbon directly from the air. "Today, it is technically possible to capture CO<sub>2</sub> from air and, through a number of steps, convert it to commercial products," says Professor Ted Sargent who led the research team. "The challenge is that it takes a lot of energy to do so, which raises the cost and lowers the incentive. Our strategy increases the overall energy efficiency by avoiding some of the more energy-intensive losses." Direct-air carbon capture is an emerging technology whereby companies aim to produce fuels or plastics from carbon that is already in the atmosphere, rather than from fossil fuels. Canadian company Carbon Engineering, which has built a pilot plant in Squamish, B.C., captures CO<sub>2</sub> by forcing air through an alkaline liquid solution. The CO<sub>2</sub> dissolves in the liquid, forming a substance called carbonate. In order to be fully recycled, the dissolved carbonate is normally turned

**Engineering researchers have developed a new electrochemical path to transform carbon dioxide into valuable products such as jet fuel or plastics.**

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back into CO<sub>2</sub> gas, and then into chemical building blocks that form the basis of fuels and plastics. One way to do this is to add chemicals that convert the carbonate into a solid salt. This salt powder is then heated at temperatures above 900 C to produce CO<sub>2</sub> gas that can undergo further transformations. The energy required for this heating drives up the cost of the resulting products. The U of T Engineering team's alternative method applies an electrolyser, a device that uses electricity to drive a chemical reaction. Having previously used electrolyzers to produce hydrogen from water, they realised that they could also be used to convert dissolved carbonate directly back into CO<sub>2</sub>, skipping the intermediate heating step entirely. "We used a bipolar membrane, a new electrolyser design that is great at generating protons," says Geonhui Lee, who along with postdoctoral fellow Y. Chris Li is among the lead authors of a new paper in ACS Energy Letters which describes the technique. "These protons were exactly what we needed to convert the carbonate back into CO<sub>2</sub> gas." Their electrolyser also contains a silver-based catalyst that immediately converts the CO<sub>2</sub> produced into a gas mixture known as syngas. Syngas is a common chemical feedstock for the well-established Fischer-Tropsch process, and can be readily turned into a wide variety of products, including jet fuel and plastic precursors. "This is the first known process that can go all the way from carbonate to syngas in a single step," says Sargent. While many types of electrolyzers have been used to convert CO<sub>2</sub> into chemical building blocks, none of them can deal effectively with carbonate. Furthermore, the fact that CO<sub>2</sub> dissolved in liquid turns into carbonate so readily is a major problem for existing technologies. "Once the CO<sub>2</sub> turns into carbonate, it becomes inaccessible to traditional electrolyzers," says Li. "That's part of the reason why they have low yields and low efficiencies. Our system is unique in that it achieves 100% carbon utilisation: no carbon is wasted. It also generates syngas as a single product at the outlet, minimizing the cost of product purification." In the lab, the team demonstrated the ability to convert carbonate to syngas at an overall energy efficiency of 35%, and the electrolyser remained stable for more than six days of operation. Sargent says that more work will be needed to scale up the process to the levels needed for industrial application, but that the proof-of-concept study demonstrates a viable alternative path for direct-air carbon capture and utilisation. "It goes a long way toward answering the question of whether it will ever be possible to

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use air-captured CO<sub>2</sub> in a commercially compelling way," he says. "This is a key step toward closing the carbon loop."

Science Daily, 29 May 2019

<http://www.sciencedaily.com>

### Laser technique could unlock use of tough material for next-generation electronics

2019-06-05

In 2004, researchers discovered a super thin material that is at least a 100 times stronger than steel and the best-known conductor of heat and electricity. This means that the material, graphene, could bring faster electronics than is possible today with silicon. But to truly be useful, graphene would need to carry an electric current that switches on and off, like what silicon does in the form of billions of transistors on a computer chip. This switching creates strings of 0s and 1s that a computer uses for processing information. Purdue University researchers, in collaboration with the University of Michigan and the Huazhong University of Science and Technology, show how a laser technique could permanently stress graphene into having a structure that allows the flow of electric current. This structure is a so-called "band gap." Electrons need to jump across this gap in order to become conduction electrons, which makes them capable of carrying electric current. But graphene doesn't naturally have a band gap. Purdue researchers created and widened the band gap in graphene to a record 2.1 electronvolts. To function as a semiconductor such as silicon, the band gap would need to be at least the previous record of 0.5 electronvolts. "This is the first time that an effort has achieved such high band gaps without affecting graphene itself, such as through chemical doping. We have purely strained the material," said Gary Cheng, professor of industrial engineering at Purdue, whose lab has investigated various ways to make graphene more useful for commercial applications. The presence of a band gap allows semiconductor materials to switch between insulating or conducting an electric current, depending on whether their electrons are pushed across the band gap or not. Surpassing 0.5 electronvolts unlocks even more potential for graphene in next-generation electronic devices, the researchers say. Their work appears in an issue of *Advanced Materials*. "Researchers in the past opened the band gap by simply stretching graphene, but stretching alone doesn't widen the band gap very much. You need to permanently change the shape of graphene to keep the band gap open," Cheng said. Cheng and his collaborators not only kept the band gap open in graphene, but also made it to where the

**Researchers make graphene tunable, opening up its band gap to a record 2.1 electronvolts**

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gap width could be tuned from zero to 2.1 electronvolts, giving scientists and manufacturers the option to just use certain properties of graphene depending on what they want the material to do. The researchers made the band gap structure permanent in graphene using a technique called laser shock imprinting, which Cheng developed in 2014 along with scientists at Harvard University, the Madrid Institute for Advanced Studies and the University of California, San Diego. For this study, the researchers used a laser to create shockwave impulses that penetrated an underlying sheet of graphene. The laser shock strains graphene onto a trench-like mould - permanently shaping it. Adjusting the laser power adjusts the band gap. While still far from putting graphene into semiconducting devices, the technique grants more flexibility in taking advantage of the material's optical, magnetic and thermal properties, Cheng said.

EurekAlert, 30 May 2019

<http://www.eurekalert.org>

### Swapping water for CO2 could make fracking greener and more effective

2019-06-05

Scientists at the Chinese Academy of Sciences and China University of Petroleum (Beijing) have demonstrated that CO<sub>2</sub> may make a better hydraulic fracturing (fracking) fluid than water. Their research, published 30 May in the journal *Joule*, could help pave the way for a more eco-friendly form of fracking that would double as a mechanism for storing captured atmospheric CO<sub>2</sub>. Fracking is a technique used to extract resources from unconventional reservoirs in which fluid (usually water mixed with sand, foaming agents, biocides, and other chemicals) is injected into the rock, fracturing it to release the resources within. Of the approximately 7-15 million litres of fluid injected, 30%-50% remains in the rock formation after extraction ends. Its high-water consumption, environmental risks, and frequent production issues have led to concerns about fracking among both industry experts and environmental advocates. "Non-aqueous fracturing could be a potential solution to circumvent these issues," says Nannan Sun, a researcher in the Shanghai Advanced Research Institute at the Chinese Academy of Sciences. "We chose CO<sub>2</sub> fracturing from a range of options because the process includes multiple benefits. However, we were still lacking a fundamental understanding of the technology, which is greatly important for its further development and deployment." Benefits of CO<sub>2</sub> fracturing include eliminating the need for a hefty water supply (which would make

**Scientists at the Chinese Academy of Sciences and China University of Petroleum (Beijing) have demonstrated that CO<sub>2</sub> may make a better hydraulic fracturing (fracking) fluid than water.**

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fracking viable in arid locations), reducing the risk of damage to reservoirs (as often happens when aqueous solutions create blockages in the rock formation), and providing an underground repository for captured CO<sub>2</sub>. However, CO<sub>2</sub> is not likely to become commonly used as a fracking fluid unless it is more effective than water at resource production. To investigate the differences between CO<sub>2</sub> and water as fracturing fluids on a microscopic level, Sun and his team collected shale outcrops from Chongqing, China and fractured them with both fluids. They found that CO<sub>2</sub> outperformed water, creating complex networks of fractures with significantly higher stimulated volumes. "We demonstrated that CO<sub>2</sub> has higher mobility than water, and, therefore, the injection pressure can be better delivered into the natural porosity of the formation," says Sun. "This changes the mechanism by which the fractures are created, generating more complex fracture networks that result in more efficient shale gas production." While the researchers believe this hydraulic fracturing technology will be scalable, its large-scale development is currently limited by CO<sub>2</sub> availability. The cost of CO<sub>2</sub> captured from emission sources is still prohibitively expensive to make CO<sub>2</sub> an industry-wide fracking fluid replacement. The team also notes that once CO<sub>2</sub> has been injected into the fracture, it acquires a low viscosity that inhibits it from effectively transporting sand to the fractures. Since the sand is intended to prop open the fractures while shale gas is harvested, it is critical that scientists learn to improve the fluid's viscosity--but the team is not yet sure how to do so while keeping costs low and minimizing the environmental footprint. As next steps, the researchers plan to study the limits of CO<sub>2</sub> fracturing technology in order to better understand how it can be used. "Further investigations are needed to identify the effects of type of reservoirs, geomechanical properties and conditions, CO<sub>2</sub> sensitivity of the formation, and so forth," says Sun. "Additionally, cooperation with industries will be carried out to push forward the practical deployment of the technology."

EurekAlert, 30 May 2019

<http://www.eurekalert.org>

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### **Cirrhosis, cancer risks higher with fatty liver - especially in diabetics**

2019-06-05

Fatty liver disease that's not related to alcohol use is linked with an increased risk of cirrhosis and liver cancer, especially in people with diabetes, according to a large study from Europe. "We probably need a more systematic way of detecting the liver disease in patients at risk so we can prevent progression," Dr. William Alazawi from Barts Liver Centre and the University of London told Reuters Health by email. "This involves raising awareness of liver disease among patients and their doctors and also making the most of the blood tests and scans that currently exist in people who we know are at risk." Non-alcoholic fatty liver disease (NAFLD) has become the most common type of liver disease worldwide. Well known causes of NAFLD include obesity, diabetes, lipid disorders, and inflammatory bowel disease. People with NAFLD who already have scar tissue (like fibrosis) are known to be at higher risk for progressing to cirrhosis (advanced scarring that makes it difficult or impossible for the liver to function) and liver cancer. Dr. Alazawi's team studied data on 18 million Europeans, to investigate the odds that people with NAFLD or NASH (a worse stage of NAFLD with liver inflammation and damage) would develop cirrhosis or liver cancer. After accounting for age, smoking, and body mass index, the researchers found people with NAFLD or NASH were almost five times more likely than people with healthy livers to develop cirrhosis and 3.5 times more likely to develop liver cancer. Compared to people with NAFLD or NASH and mild liver fibrosis, those with high-risk liver fibrosis were more than 33 times more likely to develop cirrhosis and 25 times more likely to develop liver cancer, according to the May 20th BMC Medicine online report. Among people with NAFLD or NASH, those with diabetes were more than twice as likely as those without diabetes to develop liver cirrhosis or cancer. Overall, about half of the patients who developed cirrhosis did so within two or three years after their NAFLD was first diagnosed and within as little as six months after a diagnosis of NASH. "The fact that patients acquired a diagnosis of cirrhosis or HCC within a few years of being diagnosed with NAFLD/NASH (suggests) that patients are being diagnosed late in the disease course," Alazawi said. "Knowing that diabetes is an independent predictor of cirrhosis and liver cancer is very important from a clinical point of view, as it helps us focus efforts to find patients who may benefit from intervention," Alazawi said. "Liver disease can progress 'silently' to advanced stages," he said, "and people with diabetes are at increased risk. This reminds doctors to consider assessing the liver as they review people

**Fatty liver disease that's not related to alcohol use is linked with an increased risk of cirrhosis and liver cancer, especially in people with diabetes, according to a large study from Europe.**

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with diabetes and also encourages patients to look at lifestyle, losing weight, and cutting back the amount (of alcohol) they drink."

Reuters Health, 28 May 2019

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

### Procrastinating genius: did da Vinci have attention disorder?

2019-06-05

Renaissance genius Leonardo da Vinci's litany of exquisite but unfinished work shows he probably had an attention disorder common to modern society. That is the view of psychiatry professor Marco Catani, who believes Attention Deficit and Hyperactivity Disorder (ADHD) explains both da Vinci's chronic procrastination and his creative drive in the arts and sciences. "I am confident ADHD is the most convincing and scientifically plausible hypothesis to explain Leonardo's difficulty in finishing his works," Catani, of King's College in London, argued in a scientific paper published recently. Even the Italian's most famous work, the Mona Lisa portrait, was not completely finished. Most commonly recognised in children, ADHD is now increasingly being diagnosed in adults, including people with successful careers. Symptoms include an inability to complete tasks, mind-wandering, and mental and physical restlessness. Laying out his hypothesis in the scientific journal *BRAIN*, Catani said historical records show da Vinci's struggles with sticking to tasks were pervasive from childhood. Accounts from biographers and contemporaries show he was constantly on the go, Catani said, often jumping from task to task. And like many people with ADHD, da Vinci got very little sleep and often worked continuously night-and-day. Catani, a specialist in ADHD, brain anatomy and Renaissance science, said his analysis found da Vinci spent "excessive time planning projects" but lacked perseverance. "ADHD could explain aspects of Leonardo's temperament and his strange mercurial genius," he said. Historical accounts, Catani added, also show Leonardo was left-handed and probably had two other characteristics of people with attention deficit disorder: dyslexia and a linguistic dominance in the right-hand side of his brain. In a telephone interview, Catani lamented misconceptions that people with ADHD are generally disruptive children of low intelligence and "destined for a troubled life". He hoped his analysis of da Vinci would combat such stigma and help those affected. "Leonardo considered himself as someone who had failed in life - which is incredible,"

**Renaissance genius Leonardo da Vinci's litany of exquisite but unfinished work shows he probably had an attention disorder common to modern society.**

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he said. "I hope (this case) shows that ADHD is not linked to low IQ or lack of creativity, but rather the difficulty of capitalising on natural talents."

Reuters Health, 24 May 2019

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

### States take up PFAS fight: 'Is this the next asbestos?'

2019-06-05

State lawyers are lining up in court to fight PFAS, the vexing group of chemicals linked to cancer but used broadly in cookware, firefighting foam and other materials. Litigation has increased as research and public awareness of potential impacts of per- and polyfluoroalkyl substances has grown in recent years. Now, state lawsuits against chemical manufacturers are piling up, raising the stakes for all involved. "I think you're going to see a waterfall effect. You're going to see more states doing that," said Akerman LLP attorney Matthew Schroeder, who advises companies on PFAS-related legal risks. "States are going to follow, cities are going to follow, attorneys general are going to follow," he added. "And it's going to, in turn, lead to significantly more class-action lawsuits." Research from the Centres for Disease Control and Prevention has linked some forms of PFAS — an umbrella term for a broad set of related man-made chemicals — to cancer, thyroid problems and other health issues. Thousands of individual plaintiffs have already gone to court over the past two decades with alleged injuries. States were largely absent from the legal scene until a series of lawsuits hit the courts over the past year. New Hampshire is the latest to join the fray, filing two lawsuits last week against major manufacturers for their products' impacts on natural resources. New Jersey filed its own case three weeks ago, raising environmental and consumer fraud claims. Others taking legal action include Ohio, New York and New Mexico. PFAS-related cases in North Carolina and Vermont recently settled. "We've asked the question, 'Is this the new asbestos?'" Schroeder said. Others have compared it to Agent Orange. The litigation uptick is due in part to widespread frustration with how EPA has handled the issue. The agency recently proposed a plan to clean up two of the most common forms of PFAS in groundwater, but critics say the proposal is too little, too late. David Hayes, head of New York University's State Energy and Environmental Impact Centre, said state-level involvement is critical to the ongoing fight over PFAS liability. "It certainly raises the stakes for the companies on two levels: No. 1, the states have authorities to require clean-up, and they also have the authority to define clean-up standards," he said. "And then the issue of natural resources damages is also a very

**State lawyers are lining up in court to fight PFAS, the vexing group of chemicals linked to cancer but used broadly in cookware, firefighting foam and other materials.**

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significant one. There's a lot of history about state authority as a trustee of natural resources to demand and collect damages for natural resources." Put simply, he said, "state authorities can enforce these obligations in a way that private plaintiffs can't." One state was ahead of the curve in going after PFAS. Minnesota filed suit nearly a decade ago in 2010, arguing that waste from major PFAS manufacturer 3M Co. contaminated water and land in the Twin Cities. The case settled last year when 3M agreed to pay the state \$850 million — most of which is going toward drinking water and natural resources projects in the area. Schroeder said the Minnesota case, paired with a major settlement in a private lawsuit, paved the way for the rise of state action today. And the combination of state lawsuits and thousands of private cases means the legal saga is just beginning. "We're not talking about three to five years," he said. "We're talking about 30 years. It's a new world."

#### 'Different stripes'

State lawsuits have mainly targeted PFAS manufacturers, raising a variety of legal theories. "These cases have different stripes to them," Hayes said. "Some of them, like in New Hampshire, are focused mostly on natural resource damages. Some are focused on manufacturing facilities and the immediate environs of the facilities with some sort of injunctive relief." New Hampshire's new lawsuits target companies that produced and distributed firefighting foam that contained PFAS, arguing those firms created chemicals that were dangerous to users and the environment. "The defendants possessed unique knowledge of the dangers of PFAS chemicals but continued to make and sell them without warning the public of their health risks," Attorney General Gordon MacDonald (R) said in a statement last week. "We are committed to taking all legal action necessary to ensure that those responsible account for the damage to the State and its resources caused by PFAS." Other states such as New Jersey and New York have also sued the manufacturers and sellers of PFAS in firefighting foam. New Jersey Attorney General Gurbir Grewal (D) is targeting eight manufacturers, including 3M, Chemours Co. and a DowDuPont Inc. subsidiary. "The corporations we're suing today knew full well the health and environmental risks associated with this foam, and yet they sold it to New Jersey's firefighters anyway," Grewal said in a statement. "Their conduct was unconscionable, and we're going to hold these companies accountable." In a statement to E&E News, Grewal's office noted the Garden State has stronger enforcement mechanisms than many other states, allowing it to order companies to disclose information about the use and disposal of PFAS. In addition to the state-wide suit,

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New Jersey has also filed four lawsuits focused on individual sites. "This approach is obviously what we in New Jersey have determined to be the most effective course, but the decision to bring a state-wide suit or individual suits is a matter of litigation strategy and depends on the laws and remedies available to plaintiffs," his office said. New Mexico has taken a different approach, suing the Air Force for PFAS contamination in groundwater at two bases in the state. Michigan, meanwhile, is still gearing up for a fight. The state recently launched a search for attorneys to represent the state in PFAS legal action. The "special assistant attorneys general" would work on a contingency-fee basis. According to the Environmental Working Group, Michigan has more documented PFAS sites, 192, than any other state. "Our state will spend hundreds of millions of dollars addressing these problems — costs that should not be borne by the people who live, work and play here," Michigan Attorney General Dana Nessel (D) said in a statement. "Many of those same people were poisoned here and we will make those responsible pay for their greed." PFAS cases filed so far show the issue's resonance across the political spectrum. While Democratic attorneys general tend to take the lead on other types of environmental litigation, PFAS contamination has caught the attention of Republican leaders in Ohio, New Hampshire, Alabama and elsewhere. Hayes of the State Impact Centre said there's also a possibility of multistate litigation in the future.

E&E News, 3 June 2019

<https://www.eenews.net>

### **FDA: Sampling finds toxic non-stick compounds in some food**

2019-06-05

The United States Food and Drug Administration found substantial levels of a worrisome class of non-stick, stain-resistant industrial compounds in some grocery store meats and seafood and in off-the-shelf chocolate cake, according to FDA researchers. The FDA's food-test results are likely to heighten complaints by states and public health groups that President Donald Trump's administration is not acting fast enough or firmly enough to start regulating the manmade compounds. A federal toxicology report last year cited links between high levels of the compounds in people's blood and health problems, but said it was not certain the non-stick compounds were the cause. The levels in nearly half of the meat and fish tested were two or more times over the only currently existing federal advisory level for any kind of the widely used manmade compounds,

**The United States Food and Drug Administration found substantial levels of a worrisome class of non-stick, stain-resistant industrial compounds in some grocery store meats and seafood and in off-the-shelf chocolate cake, according to FDA researchers.**

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which are called per- and polyfluoroalkyl substances, or PFAS. The level in the chocolate cake was higher: more than 250 times the only federal guidelines, which are for some PFAS in drinking water. Food and Drug Administration spokeswoman Tara Rabin said that the agency thought the contamination was “not likely to be a human health concern,” even though the tests exceeded the sole existing federal PFAS recommendations for drinking water. As a handful of PFAS contaminations of food emerge around the country, authorities have deemed some a health concern but not others. The agency considers each discovery of the compound in food case by case, including the kind of food, levels of contamination, frequency of consumption and latest scientific information, Rabin said. There are nearly 5,000 varieties of PFAS, which DuPont created in 1938 and first put into use for non-stick cookware. Industries use them in countless consumer items — food packaging, carpets and couches, dental floss and outdoor gear — to repel grease, water and stains. The chemicals also are found in firefighting foam, which the Defence department calls irreplaceable in suppressing jet-fuel fires. Especially around military bases and PFAS facilities, decades of use have built up levels in water, soil and some treated sewage sludge used to fertilize non-organic food crops and feed for livestock. They’ve been a topic of congressional hearings, state legislation and intense federal and state scrutiny over the past two years. Last year’s federal toxicology review concluded the compounds are more dangerous than previously thought, saying consistent studies of exposed people “suggest associations” with some kinds of cancers, liver problems, low birth weight and other issues. The compounds have been dubbed “forever chemicals” because they take thousands of years to degrade, and because some accumulate in people’s bodies. The Environmental Protection Agency earlier established a nonbinding health threshold of 70 parts per trillion for two-phased out forms of the contaminant in drinking water. The EPA has said it would consider setting mandatory limits instead after the toxicology report and after federally mandated PFAS testing of water systems found contamination. The administration has called dealing with PFAS a “potential public relations nightmare” and a “national priority.” “I know there are people who would like us to move faster” on PFAS, EPA Administrator Andrew Wheeler said Monday at the National Press Club. “We are addressing this much faster than the agency has ever done for a chemical like this.” Impatient for federal action, several states have moved to regulate the chemicals on their own, including setting standards for groundwater or drinking water. The FDA study sampled market-basket items bought in three, undisclosed mid-Atlantic cities in 2017, testing for PFAS. PFOS — already phased out of production in the U.S. as a health concern — turned up at levels ranging

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from 134 parts per trillion to 865 parts per trillion in tilapia, chicken, turkey, beef, cod, salmon, shrimp, lamb, catfish and hot dogs. Chocolate cake tested at 17,640 parts per trillion of a kind of PFAS called PFPeA. The FDA presentation also disclosed PFAS findings — one spiking over 1,000 parts per trillion — in leafy green vegetables grown within 10 miles (16 kilometres) of an unspecified eastern U.S. PFAS plant and sold at a farmer's market. And it previewed test levels for a previously reported instance of PFAS contamination of the food supply in the feed and milk at a dairy near an Air Force base in New Mexico. The FDA called the milk contamination a health concern. FDA researchers discussed the results at a conference by the Society of Environmental Toxicology and Chemistry recently in Finland. The Environmental Defence Fund and the Environmental Working Group obtained the FDA presentation and provided it to The Associated Press. "What this calls for is additional research to determine how widespread this contamination is and how high the levels are," said Linda Birnbaum, director of the National Institute of Environmental Health Sciences, in an interview. "We have to look at total human exposure — not just what's in the water or what's in the food ... or not just dust. We need to look at the sum totals of what the exposures are." "Drinking one glass of contaminated water is unlikely to be associated with health risks, as is eating one slice of contaminated chocolate cake," said Jamie DeWitt, a toxicologist at East Carolina University who studies PFAS. "Individually, each item is unlikely to be a huge problem, but collectively and over a lifetime, that may be a different story."

AP News, 4 June 2019

<https://www.apnews.com>

## How Monsanto manipulates journalists and academics

2019-06-05

Over the past year, evidence of Monsanto's deceptive efforts to defend the safety of its top-selling Roundup herbicide have been laid bare for all to see. Through three civil trials, the public release of internal corporate communications has revealed conduct that all three juries have found so unethical as to warrant punishing punitive damage awards. Much attention has been paid to Monsanto conversations in which company scientists casually discuss ghost-writing scientific papers and suppressing science that conflicts with corporate assertions of Roundup's safety. There has also been public outrage over internal records illustrating cosy relationships with friendly regulators which border on – and possibly cross into – collusion. But these once-confidential Monsanto documents

**Monsanto's own emails and documents reveal a disinformation campaign to hide its weedkiller's possible links to cancer**

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demonstrate that the deception has gone much deeper. In addition to the manipulation of science and of regulators, the company's most insidious deceit may be its strategic manipulation of the media, according to the records. We recently learned that a young woman falsely posing as a freelance BBC reporter at one of the Roundup cancer trials was in fact a "reputation management" consultant for FTI Consulting, whose clients include Monsanto. The woman spent time with journalists who were covering the Hardeman v Monsanto trial in San Francisco, pretending to do reporting while also suggesting to the real reporter's certain storylines or points that favoured Monsanto. Lawyer Tim Litzenburg, who represents several plaintiffs suing Monsanto over claims Roundup causes cancer, told me that he has traced what he calls a "dark money project" by Monsanto aimed at winning favourable public opinion. The project includes planting helpful news articles in traditional news outlets; discrediting and harassing journalists who refused to parrot the company's propaganda; and secretly funding front groups to amplify pro-Monsanto messaging across social media platforms. "We now know they had pet journalists who pushed Monsanto propaganda under the guise of 'objective reporting,'" Litzenburg, a partner with the firm Kincheloe, Litzenburg & Pendleton, told me. "At the same time, the chemical company sought to amass dossiers to discredit those journalists who were brave enough to speak out against them." According to the internal Monsanto documents Litzenburg has received through discovery, pro-Monsanto narratives are disseminated by individuals and groups that promote the work of journalists who follow Monsanto's desired storylines while seeking to smear and discredit journalists whose work threatens Monsanto. For me, a career journalist who spent 17 years covering Monsanto for the international news agency Reuters, the revelations are not surprising. In 2014, an organisation called Academics Review published two scathing articles about my work at Reuters writing about Monsanto's genetically engineered crops and its Roundup herbicide business. Monsanto had been unhappy with some of my stories, complaining that I should not be including the views of company critics. Academics Review amplified those complaints under the guise of being an independent association. Internal Monsanto documents have revealed, however, that Academics Review was and is anything but independent. The organisation was the brainchild of Monsanto, designed as a vehicle for responding to "scientific concerns and allegations" while "keeping Monsanto in the background so as not to harm the credibility of the information," as one November 2010 email from Monsanto executive Eric Sachs stated. According to a March 11, 2010 email chain, Academics Review was established with the help of a former director of corporate communications at Monsanto who set up his own public relations shop

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and a former vice president of a biotech industry trade association of which Monsanto was a member. Other internal documents show Monsanto's money and marching orders behind the American Council on Science and Health (ACSH), an organisation that purports to be independent of industry while publishing articles attacking journalists and scientists whose work contradicts Monsanto's agenda. Articles written by ACSH associates have appeared in USA Today, the Wall Street Journal and Forbes. ACSH has published several articles aimed at discrediting not just me but also Pulitzer-prize-winning New York Times reporter Eric Lipton, who ACSH calls a "science birther", and former New York Times reporter Stephanie Strom, who ACSH accused of "irresponsible journalism" shortly before she left the paper. Both reporters had written articles exposing concerns about Monsanto. The New York Times' Danny Hakim has also been targeted by ACSH for writing about Monsanto. "Danny Hakim Is Lying To You," reads one of several posts by ACSH about Hakim.

Internal Monsanto emails show ACSH seeking and receiving financial commitments from Monsanto. One email string from 2015 between the company and ACSH details the "unrestricted" financial support ACSH desires while laying out the "impacts" across social media ACSH is achieving. "Each and every day we work hard to prove our worth to companies like Monsanto..." the ACSH email states. A separate email chain among Monsanto executive's state "You will not get a better value for your dollar than ACSH." Tom Philpott, a long-time journalist with Mother Jones magazine who has written critically about genetically modified crops for several years, has also felt the sting of industry harassment. "These are vicious and utterly unfounded attacks on a journalist's credibility, well designed to undercut him with his employer," he told me. While harassing reporters whose coverage it deems negative, Monsanto has also found ways to cultivate certain journalists to carry its messaging. Monsanto's internal documents show that when the company wanted to discredit the International Agency for Research on Cancer (IARC) after the group classified Monsanto's glyphosate weed killer as a probable carcinogen, Monsanto turned to a London-based Reuters reporter with specific story suggestions. The emails show that a controversial story published in June 2017 by Reuters, raising questions about the integrity of the IARC's review of glyphosate, was secretly fed to the news agency by Monsanto executive Sam Murphey. Murphey gave the reporter documents that had not yet been filed publicly in court along with a desired story narrative and a slide deck of suggested points to make in the story. The story, which did not disclose Monsanto as the initial source, closely followed Monsanto's suggestions, the emails show. Another newly released email

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details how Monsanto's fingerprints were on at least two other Reuters stories about the IARC. A 1 March 2016 email speaks of the involvement of Monsanto's "Red Flag" campaign in a Reuters story critical of IARC and Monsanto's desire to influence a second, similar story Reuters was planning. Red Flag is a Dublin-based PR and lobbying firm. According to the email, "following engagement by Red Flag a number of months ago, the first piece was quite critical of IARC." The email goes on: "You may also be aware that Red Flag is in touch with Reuters regarding the second report in the series...". A little over a month later, Reuters published a story headlined "Special Report: How the World Health Organisation's cancer agency confuses consumers." The stories in question were shared by ACSH, the American Chemistry Council, Monsanto and others. In Europe, French prosecutors are now probing Monsanto's campaign to manipulate journalists and others, including secret files on influential individuals compiled by Monsanto public relations firm FleishmanHillard. Bayer AG, the German company that acquired Monsanto last June, has admitted that FleishmanHillard created lists of people in France, Germany, Italy, the Netherlands, Poland, Spain and the United Kingdom on behalf of Monsanto. The company has apologised for the secret files and said it is hiring an external law firm to investigate the matter. In the United States, Raymond Kerins, Bayer's head of communications, told me that the company "stands for openness and fair dealings, with all of our audiences, including the news media." The comment rings hollow as the character attack pieces on me and other journalists continue to circulate and Monsanto's history of harassment and media manipulation seems to be growing – just as the number of plaintiffs alleging Roundup causes cancer also grows. It's time for the dishonesty to end.

*\*Carey Gillam is a journalist and author, and a public interest researcher for US Right to Know, a not-for-profit food industry research group*

The Guardian, 2 June 2019

<http://www.guardian.com>

## Those Gene-Hacked Babies May Be Doomed To Die Young

2019-06-05

About half a year after Chinese scientist He Jiankui first brought gene-hacked babies into the world, cooler heads have finally prevailed: scientists pored over hundreds of thousands of medical records to learn how the genes that He altered affect human health. He's team gene-

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hacked the twin babies — and a third baby due this summer — to knock out a gene called CCR5 in hopes that it would render them immune to HIV. But according to new research published in the journal *Nature Medicine*, people with that genome are 21 percent more likely to die before reaching the average life expectancy.

### Trade-off

Scientists from UC Berkeley searched a repository of human subjects' DNA to look for the same variants of the CCR5 that He Jiankui gave the children, NPR reports. They found that the same genome that might grant greater immunity from HIV also makes people vulnerable to dangerous flu and West Nile virus. "What we found is that they had significantly increased mortality," lead researcher Rasmus Nielsen told NPR. "It's rather substantial. We were quite surprised the effect was this large."

### Measure Twice

He's experiments have spurred many scientists to recommend against gene-hacking human embryos until we know more. "This is a lesson in humility," George Daley, dean of Harvard Medical School, told NPR. "Even when we think we know something about a gene, we can always be surprised and even startled, like in this case, to find out that a gene we thought was protective may actually be a problem."

Futurism, 4 June 2019

<https://futurism.com>

## **Spraying Stem Cells Up The Noses of Mice Has Restored Their Sense of Smell**

2019-06-05

Imagine a simple and effective treatment for restoring the sense of smell in people who have lost it or never had it in the first place – that could one day be possible as a result of early stage research on mice, in which olfactory nerves were replenished using stem cells. Using droplets of globose basal cells – the same cells that naturally replace damaged and ageing neurons related to smell – scientists were able to get them to develop into full nerve cells, stretching right into the brain. Ultimately a few squirts of stem cells were able to reconnect the axons leading to the olfactory signalling in the brains of the mice. Scientists are still a long way from repeating the trick with human beings, but it's a very promising start. "This is the first model of smell loss showing evidence of recovery using

**Imagine a simple and effective treatment for restoring the sense of smell in people who have lost it or never had it in the first place – that could one day be possible as a result of early stage research on mice, in which olfactory nerves were replenished using stem cells.**

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a cell-based therapy," says lead researcher and otolaryngologist Bradley Goldstein, from the University of Miami. "It is very important to understand that many questions would need to be worked out before considering this in a human patient. However, it does provide evidence that such an approach warrants further study." Goldstein and his colleagues worked with mice that had been genetically modified to lose their sense of smell – in particular, the absence of the IFT88 gene meant the mice cells lacked cilia, the tiny hair-like structures that detect scents and odours. After the globose basal cells were applied, and developed into fully mature olfactory sensory neurons inside the olfactory epithelium (the nasal cavity), the treated mice started reacting to bad smells. "There is some evidence that a failure to normally replace damaged or lost olfactory neurons may contribute to many forms of acquired olfactory loss," says Goldstein. "So, we were interested in testing the idea that a cell-based therapy approach, to replace neurons, might be plausible." "We were a bit surprised to find that cells could engraft fairly robustly with a simple nose drop delivery." In the US, 12 percent of the population have problems with their sense of smell, due to ageing, a genetic disorder, or some kind of injury. That's almost 40 million people, and right now there aren't a lot of treatments available. With many of those issues seemingly linked to the olfactory epithelium and its tissue lining, this stem cell approach might work – though adapting the approach to see if it is as effective in human beings is going to take time. Scientists will also need to make sure there aren't any adverse side effects. A healthy sense of smell not only enriches life – when walking through a garden or a kitchen perhaps – it can also act as a useful warning system for everything from out-of-date food to a gas leak. "To be potentially useful in humans, the main hurdle would be to identify a source of cells capable of engrafting, differentiating into olfactory neurons, and properly connecting to the olfactory bulbs of the brain," says Goldstein. "Further, one would need to define what clinical situations might be appropriate, rather than the animal model of acute olfactory injury." The research has been published in Stem Cell Reports.

Science Alert, 2 June 2019

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

## Wild Bees Have Been Found Building Nests Entirely Out of Plastic Waste

2019-06-05

In the crop fields of Argentina, bees have been building nests for their young out of some strange materials. For the first time, scientists have

**In the crop fields of Argentina, bees have been building nests for their young out of some strange materials.**

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found bee nests made entirely out of plastic waste. A lot of plastic in the form of packaging comes into farms, and often makes its way into the landscape. The world is changing, and wildlife is having to adapt - but whether they can adapt fast enough to keep up with human impact is still up for debate. Researchers from Argentina's National Agricultural Technology Institute discovered the plastic nests as part of their research into chicory pollinators. The team had set up 63 trap nests around crop fields: these are a bit like those bee hotels that you can build in your backyard for solitary bees, with long, hollow tubes, similar to the honeycomb holes where bee larvae grow. Bees can line these cavities with materials they forage such as mud, leaves, stone, petals and resin. They build these materials into a cosy nest in the cavity, separated into brood cells along the length, each of which holds a growing bee larva. Over the spring and summer of 2017 and 2018, the team checked their trap nests monthly to look for signs of bee activity. They only found three nests the bees used. Two were built with mud and petals, and five healthy adult bees emerged from them. The third had three cells entirely constructed out of plastic, carefully cut into oblong and oval shapes by the bee, and arranged in an overlapping manner. The first two cells were constructed of thin, light blue plastic, similar to a plastic shopping bag. The third cell was made of thicker white plastic. "Among the three cells," the researchers wrote in their paper, "one contained a dead larva; from the other, the adult seemed to have emerged from the nest; and the third cell was not finished." So, of the two occupied cells, one larva died and the other grew to adulthood - indicating that plastic might not be the best choice of building material, but it might not be the worst, either. The team were unable to make a positive identification of the bee that had built the nest, but believe it may have been an alfalfa leafcutter bee (*Megachile rotundata*). This is an introduced European species the team had previously seen in the study site, and its lifestyle fits. It's a solitary bee that, true to its name, cuts leaves to line its nests, similar to the manner in which the plastic fragments were trimmed. And, in North America, scientists have documented this particular bee using plastic to construct individual brood cells within a larger nest. What makes this new nest so striking is that all the cells in the nest were constructed of plastic; and it's the first documented case where two different types of plastic were used. And it might not actually be bad news. It could, the researchers said, mean that bees have an adaptive flexibility that will allow them to keep up with rapid environmental changes. Or it might mean that herbicides used in fields are reducing the number of plants the bees prefer to use in their nests. Or, because the bee in this instance only used plastic, without any leaves, it prefers that material for another reason - maybe plastic

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provides an adaptive advantage we are unaware of, the way some birds use cigarette butts to repel parasites. It's impossible to tell from a single nest. "However," the researchers wrote, "it could highlight bees' response capacity in the search for alternative materials for the construction of their nests in the face of human disturbance." The research has been published in *Apidologie*.

Science Alert, 31 May 2019

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

### **Obesity, chemical exposure speed up early puberty in children**

2019-06-05

Body changes accompanying aging is natural, but this can be a problem at times for some children who start physical development sooner than their peers. Early puberty means a child's body begins to change into that of an adult, showing secondary sex characteristics. It is usually classified as early puberty when a child shows such characteristics before the age of eight or nine—girls before eight and boys before nine—which is two years earlier than average. According to data from the National Health Insurance Corp., the number of children who reached puberty too early stood at 95,401 in 2017, up from 67,021 in 2013, with an annual growth rate of 9.2 percent. Parents are particularly concerned about "precocious puberty," which brings rapid growth and changes in body shape and size. When puberty ends, growth in height usually slows because children's skeletons mature and bone growth decreases. So early puberty could mean an earlier-than-normal halt to growth in height. "Children with precocious puberty usually do not reach their full adult height potential. The early growth spurt makes them tall compared to their peers, but the possibility of them having an early end to growth is higher, so they could end up shorter than they would have been," said Jung In-hyuk, a paediatrician at the National Health Insurance Service Ilsan Hospital. Among children who visited doctors for early puberty in 2017, 85,806 or 89.9 percent were girls. However, the annual increase rate among boys has outpaced that of girls, 12.8 percent compared to 8.9 percent.

#### Causes of early puberty

Jung said worsening environmental pollution, the increasing rate of obesity due to rapidly changing dietary habits, and a family history of early puberty are the main causes of the steadily increasing numbers in

**Worsening environmental pollution, the increasing rate of obesity due to rapidly changing dietary habits, and a family history of early puberty are the main causes of the steadily increasing numbers in precocious puberty.**

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precocious puberty. He also pointed out that there is no clear scientific evidence showing why the number of girls reaching early puberty is higher than boys. "It is said because many endocrine disruptors are similar to female hormones and fat cells produce female hormones." According to a recent study on 338 children from birth through adolescence, conducted by the Centre for Environmental Research and Children's Health at the University of California in the United States, chemicals have been linked to early puberty including phthalates, which are often found in scent products such as perfumes, soaps and shampoos; parabens, which are used as preservatives in cosmetics; and phenols, which include triclosan. In the study, over 90 percent of the tested children's urine samples showed high concentrations of all the potentially hormone-altering chemicals. Kim Ho-sung, a paediatrician at the Severance Children's Hospital, also said obesity might be responsible for a large portion of precocious puberty. "When body fat increases, the level of the hormone leptin also increases. Exposure to high levels of the hormone could affect early body changes," Kim said. According to the data from the Ministry of Education on 108,000 students at 1,023 elementary, middle and high schools nationwide in 2018, 25 percent were in the obese group. The ministry said the children's eating and exercise habits were strongly related to the increase in obesity, as 65.9 percent of elementary students ate fast food and processed food at least once a week. Despite the unhealthy dietary habit, only 59 percent of elementary students do strenuous exercise at least three times a week. Kim said there is no special method to help children grow normally and healthy. "Just let them eat healthy, sleep enough, and have enough free time to get rest. These are what children need," Kim said.

The Korea Times, 2 June 2019

<http://www.koreatimes.co.kr>

## Newly Discovered Hybrid Immune Cell Could Finally Explain The Cause of Type 1 Diabetes

2019-06-05

We've known for a while now that type 1 diabetes is caused by the immune system turning against the body's insulin-producing cells. But exactly what causes this traitorous act has never been clear. A newly discovered 'hybrid' white cell could finally explain this, and possibly even help us understand the origins of a variety of other auto-immune disorders. Research led by a team at Johns Hopkins University School of Medicine has identified a unique variety of white blood cell displaying features of two of our immune system's most important cells. "The cell

**A newly discovered 'hybrid' white cell could finally explain what causes the immune system to turn against the body's insulin-producing cells**

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we have identified is a hybrid between the two primary workhorses of the adaptive immune system, B lymphocytes and T lymphocytes," says pathologist Abdel-Rahim A. Hamad from the Johns Hopkins University School of Medicine. Together, these two types of lymphocyte engage in a bounty hunt for invaders and rogue cells that put the body at risk. B cells act as the dispatcher, providing important details that help identify the body's 'top most wanted' list. After maturing in bone marrow, they head to places like the lymph nodes where they become familiar with chemical signatures called antigens – scraps of material left over from battles with past threats. Using these identifying features they produce antibodies that can alert the body to the same threat in the future. T cells, on the other hand, can be thought of as the street-wise hunters out on the prowl for cells-gone-bad. The variety known as cytotoxic or 'killer' T cell looks around the body for cells with antigens on their surface, and destroys them before they can do any harm. Another type of T cell called a 'helper' tells immature B cells to prepare for war by dividing quickly and heading out into the field where they can distribute antibodies like wanted posters. After the dust settles, some of those B cells can stick around to serve as a reminder in case the threat returns. Analogies aside, these actions depend on a complex array of hormones and interactions involving specific cell receptors - and they're bound to get it wrong sometimes. One example is when T cells respond to insulin as if it's an antigen. Researchers have speculated this is the primary cause of type 1 diabetes, where insulin producing islet cells in the pancreas are ravaged early in life by an immune attack. This involves a type of antigen-presenting cell, which include macrophages and B cells, with a variant surface marker commonly associated with autoimmune conditions like diabetes and coeliac disease called DQ8. Insulin binds to DQ8, which would hypothetically cause T cells to run off half-cocked looking to kill anything that might resemble it. "However, our experiments indicate that it is a weak binding and not likely to trigger the strong immune reaction that leads to type 1 diabetes," says Hamad. There seems to be a missing piece to the story. So, the researchers went digging to find out what could turn a loose connection into a sure-fire hit, starting where they left off on earlier research on B cells. Using blood samples taken from volunteers recruited via the Johns Hopkins Comprehensive Diabetes Centre, they stumbled across a strange population of white cells displaying cell receptors for both T and B cells. Further analysis revealed these cells had uniquely expressed genes, along with the activation of the kinds of genes associated with each individual cell line. It was a B cell, a T cell, and its own special kind of cell. "This probably accentuates the autoimmune response because one lymphocyte is simultaneously performing the functions that normally require the

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concerted actions of two," says Hamad. The team discovered the B cell receptors on this strange dual expresser (DE) cell coded for a protein that could help explain the hyped-up insulin reaction. Based on computer simulations, the protein – called x-I<sub>d</sub> – binds to DQ8 with a thousand times the strength of insulin. The result is a massive increase leap in the T cell response, which could potentially drive its war against the pancreatic cells. "This finding, combined with our conclusion that the x-I<sub>d</sub> peptide primes T cells to direct the attack on insulin-producing cells, strongly supports a connection between DE cells and type 1 diabetes," says Hamad. Both the peptide and hybrid white cells were more likely to be found in the blood of diabetic patients, adding to the likelihood that they could be responsible for the disease on some level. It's not only type 1 diabetes that could at last have a detailed explanation. The researchers speculate these DE cells might play a role in other autoimmune disorders such as multiple sclerosis and rheumatoid arthritis. Further research will help confirm the cell's actions and maybe even provide insight into potential early treatments for these debilitating immune conditions. This research was published in *Cell*.

Science Alert, 31 May 2019

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

### Preemies and early arrivals have higher risk of heart disease as adults

2019-06-05

Babies who are born too soon may be more likely to develop heart disease as adults than full-term infants, a new study suggests. Adults who were born before 37 weeks gestation were 53 percent more likely to develop heart disease than people who were full-term babies, researchers found. And people who'd been born just a little bit early - at 37 to 38 weeks gestation - were 19 percent more likely to develop heart disease. Pregnancy normally lasts about 40 weeks, and babies born after 37 weeks of gestation are considered full-term. Babies born prematurely - earlier than 37 weeks - often have difficulty breathing and digesting food in the weeks after birth. Preemies can also encounter longer-term challenges such as impaired vision, hearing and cognitive skills, as well as social and behavioural problems. Preterm birth has also been linked to an increased risk of high blood pressure and diabetes decades later. But research to date hasn't conclusively linked an early delivery to an increased risk of so-called ischemic heart disease, which happens with the arteries narrow and limit how much blood and oxygen reach the heart. For the current study, researchers examined data on more than 2.1 million babies born

**Babies who are born too soon may be more likely to develop heart disease as adults than full-term infants, a new study suggests.**

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in Sweden between 1973 and 1994, following them through 2015 to see how many developed heart disease. Only 1,921 of these babies, or less than one percent, went on to be diagnosed with heart disease by ages 30 to 43. "Preterm birth interrupts the development of the cardiovascular system and other organs, leading to abnormal structure or function of blood vessels and other disorders such as diabetes that can lead to heart disease," said lead study author Dr. Casey Crump of the Icahn School of Medicine at Mount Sinai in New York City. "Our findings were not explained by maternal factors that might contribute to both preterm birth and future heart disease, such as obesity, hypertension, diabetes, and smoking," Crump said by email. "In addition, we also compared persons born preterm with their siblings who were not, which suggested that the findings were not explained by other risk factors shared within families, but were more likely from direct effects of preterm birth." For every 100,000 babies born at full term each year, about 5.9 would develop heart disease as adults, researchers calculated. That compares to about 6.5 of every 100,000 babies born slightly early and 8.8 of every 100,000 preemies. One limitation of the study is that researchers lacked more detailed clinical data needed to verify the heart disease diagnoses, the study authors note. They also had too few extremely preterm babies to draw firm conclusions about the heart risks associated with delivery earlier than 34 weeks gestation. Another drawback is that the follow-up period was too brief to detect differences in heart disease rates later in adulthood, when the condition is more commonly diagnosed. Even so, the results suggest that adults born even a little bit early should take extra precautions to protect the heart, said Dr. Thuy Mai Luu of the University of Montreal and CHU Sainte-Justine in Canada, who co-authored an editorial published with the report. "Some risk factors associated with cardiovascular diseases can be prevented through healthy lifestyle habits including a diet rich in fruits and vegetables, reduced sedentary time, regular physical activity and avoidance of primary and secondary smoke exposure," Luu said by email. "This is important to all, but maybe more so for children and adults born preterm," Luu added. "Given that it is hard to change behaviours, adopting a healthy lifestyle early in childhood is crucial; parents are central to this."

Reuters Health, 4 June 2019

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

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### ADHD may be more common among elite athletes

2019-06-05

ADHD (attention-deficit/hyperactivity disorder) may be more common in elite athletes, a new research review suggests. In fact, ADHD likely plays a role in some athletes' career choices and achievements, and proper management of the condition is important for safety and performance, the review authors note in the *British Journal of Sports Medicine*. Often, however, "elite athletes can't get proper treatment and care due to lack of knowledge and stigma," said study author Dr. Doug Hyun Han of Chung Ang University Hospital in Seoul, South Korea. ADHD is a common brain condition that affects an estimated 3% to 7% of people worldwide, and roughly 7% to 8% of elite athletes, the review team notes. The condition can include problems with attention and impulsivity that cause difficulties in academic, work and personal relationships. "The focus of management should be on medications and psychosocial treatment to optimise long-term outcomes for elite athletes in sport and life," Han told Reuters Health by email. Han, with co-authors from the U.S. National Collegiate Athletic Association, the University of Maryland and University of Wisconsin-Madison, searched medical databases for research involving ADHD, sports participation and elite athletes at professional, Olympic or collegiate levels. Han and colleagues couldn't find many official reports or previous research about ADHD in elite athletes, but the few existing reports seem to indicate that rates are higher than in the general population. In a 2018 systematic review of 17 studies, about 4% to 8% of 15- to 19-year-old athletes had ADHD. In another study, 7% of college athletes were taking stimulant medication for ADHD. The review authors also looked at ADHD medication use documented under Major League Baseball's Therapeutic Use Exemption, which allows athletes to request permission to take a medication on the World Anti-Doping Agency Prohibited List. During the 2017-2018 off-season until the end of the 2018 season, 101 players, or 8.4%, were granted exemptions. The authors note that other conditions might explain ADHD-like symptoms or exist alongside the disorder, such as mood disorders, anxiety disorders, intellectual and learning disorders, autism spectrum disorder and substance use disorders. Concussion, for example, is frequently reported in athletes alongside ADHD, and ADHD is associated with prolonged recovery after a concussion. Such associated conditions could impair sports performance, the reviewers note. Still, studies have shown that elite players, especially in baseball and basketball, may benefit from being impulsive, the authors write. A study of Korean professional baseball players found they had higher than average novelty-seeking traits, which are linked with hyperactivity, exhilaration

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and excitement with new stimuli. Sports participation itself could be a physical outlet for intense emotion and stress, reducing ADHD symptoms, the reviewers add. "ADHD might actually have positive effects on sports performance, and we need to study that more," said Dr. George Pujalte, a sports medicine specialist at the Mayo Clinic in Jacksonville, Florida, who wasn't involved in the review. Sports that require reactive decision-making and quick movements could benefit, he said. The phenomenon of "hyperfocusing" may allow athletes to block out distractions, for instance. At the same time, stimulants can be misused for performance enhancement, so mental health professionals, nutritionists and sports physicians should work together to help elite athletes manage their ADHD. "Researchers are just scratching the surface on understanding the unique effects of ADHD on athletes," Pujalte told Reuters Health by email. "We need to keep an open and inquisitive mind whenever we hear about high-level athletes with the condition or who are taking stimulants."

Reuters Health, 1 June 2019

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

### Two brain-rejuvenating proteins have been identified in young blood

2019-06-05

The brain-boosting ingredients of young blood could be two proteins. The proteins help rejuvenate important structures in neurons and may be responsible for why young blood seems to improve cognitive performance in older brains. The rejuvenating power of young blood has been linked to reducing the risk of many diseases, including cancer, heart disease, and Alzheimer's. It has also been linked to boosting cognition in older animals. To understand how this works, Thomas Südhof at Stanford University and his colleague applied blood serum from young, two-week-old mice and old, 12- to 15-month-old mice separately to human neurons. The team found that the blood serum from young mice had a profound effect on the neurons, causing the growth of a number of key structures needed for the cells to communicate. The young serum led to the cells creating more synapses, while the neurons given the old mouse serum were unaffected. Südhof and his colleagues found the serum from young mice was rich with two proteins, THBS4 and SPARCL1, both of which play a number of roles in the growth and organisation of cells in the body. When they applied only these proteins to human neurons, they saw the same "dramatically enhanced" synapse formation and activity, Südhof wrote. This is an exciting study that reveals two new proteins that previously weren't

**The brain-boosting ingredients of young blood could be two proteins.**

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known to be involved in the brain boosting effects of young blood, says Thomas Fath of Macquarie University. As well as ensuring healthy ageing, these proteins could be used to treat neurodegenerative diseases in the future, says Fath.

New Scientist, 3 June 2019

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

### Health experts wary of EPA rush to revise carcinogen testing

2019-06-05

The United States Environmental Protection Agency plans to quickly revamp its guidelines for evaluating whether environmental contaminants can cause cancer or other ailments, a move Trump administration critics fear is part of a broader effort to weaken the basis for regulating a wide range of pollutants. At issue is a fundamental responsibility of the agency: How to determine whether potentially harmful substances pose an unacceptable risk to human health and the environment. The outcomes of such risk reviews can then be used by EPA's regulatory offices and other agencies to, for example, limit the types of pesticides that farmers can apply to their crops or the amount of hazardous air pollutants oil and gas refineries can emit. EPA sources say the Trump administration is now seeking to revise the standards for that highly scientific process in a matter of months. That timeline, experts fear, makes it impossible to do a thorough job and could take years to fix—leaving millions of Americans at greater risk from unhealthy levels of pollution in the meantime. Currently, EPA has 166 pages of guidelines for assessing cancer-causing risks and no uniform guidance for evaluating other potentially adverse health effects. But next week, EPA will ask its influential Science Advisory Board (SAB) for "advice regarding upcoming actions related to an update to the '2005 EPA Guidelines for Carcinogen Risk Assessment' and creation of guidelines for non-cancer risk assessment," the agency said in a Federal Register notice earlier this month. Unlike other topics on the agenda for the meeting—EPA's proposals to increase scientific "transparency," redefine "waters of the United States," and manage toxic non-stick chemicals known as PFAS—the agency hasn't publicly released any background documents or briefing materials on its aims for the risk assessment guidelines. EPA's press office declined to provide further information on the scope and timeline of the agency's review. "EPA is just starting the process of determining what revisions are appropriate," an EPA spokesperson said in a statement. "The Agency does not at this time have a projected schedule." But ahead of

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that event, EPA leaders asked a small group of career officials to identify risk assessment topics for the SAB to consider that could be updated by the end of the year, according to two agency sources. Those officials discussed specific, limited updates to the existing cancer guidelines. Now some officials are beginning to worry that EPA leadership is looking to use that effort to weaken the guidelines and get outside approval for their changes. On the current timeline, the SAB, which has been stocked with industry-friendly members during the Trump administration, could bless the new guidelines before any potential new administration could take office in 2021—making them harder to undo.

### Risks of cancer “will be higher”

That aggressive timeline for two important and scientifically complex guidelines has also raised concerns among former agency officials and public health advocates about the potential outcome and motives for the fast-tracked review. “If you want to have anything that’s decent, you can’t do in that amount of time,” said Penny Fenner-Crisp, who served as a staff scientist at EPA for 22 years. She left the agency in 2000 after helping to craft and review EPA’s 1986 cancer guidelines. “It isn’t a matter of just sitting down and writing something,” said Fenner-Crisp, who’s now retired. “There are all sorts of internal agency reviews and sign-offs. The guidelines have to go over to [the Office of Management and Budget] and the White House. And there has to be peer review done at least once by the SAB, and maybe more than once.” It would also be good, she said, for EPA to consult with the independent National Academy of Sciences, which in 2009 offered a series of recommendations to the agency to improve its human health risk assessment practices. All of that would take at least four years to complete, Fenner-Crisp estimated. The 2005 update to EPA’s cancer guidelines, she noted, took over a dozen years to complete. To thoroughly evaluate all recent research advances, another update to the cancer guidelines is probably in order, argued Bernard Goldstein, who served as EPA’s assistant administrator for research and development during the Reagan administration. “The problem is, there’s no way it can be done in any serious way between now and December 2020,” said Goldstein, who is also dean emeritus of the University of Pittsburgh Graduate School of Public Health in Pennsylvania. “The danger is you’ll just get it wrong and for 15 years, you’ll be doing it wrong,” he said. “It means the risks of cancer that will be allowable will be higher.” Crafting guidance for evaluating all the other health risks posed by chemicals and other contaminants would likely be an even heavier lift, according to Fenner-Crisp. “The first project I worked on at the agency in the guideline area was an assignment to

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write noncancer guidelines," she said. "We laboured for two years and came to a stalemate because we couldn't resolve the definition of 'adverse.' So, the project got dropped and you've never seen the agency issue any noncancer guidelines since." EPA didn't commit to offering the planned guideline revisions up for outside scrutiny — aside from at next week's SAB meeting. But a spokesperson said, "It has been EPA's practice to take public comment on draft Guidelines and to subject them to independent external peer review." The agency didn't respond to a request for comment on critics' concerns about the guideline overhaul. Fenner-Crisp plans to air her issues with the rush to remake the risk assessment process at next week's SAB meeting. She and Goldstein are both members of the Environmental Protection Network, a coalition of retired EPA appointees and staffers committed to fighting efforts they believe could undermine their former agency.

### "Fundamental" change to EPA

Public health advocates like Richard Denison, lead senior scientist at the Environmental Defence Fund, see the push to overhaul risk assessments as part of an increasing focus by political appointees to alter the way EPA views science and pollution during Trump's time in office. He pointed to efforts to replace academics on the SAB who've gotten grants from EPA with ones who've worked for industry and shift resources from the science-focused Integrated Risk Information System chemical testing program to the toxics office, which for much of the Trump administration has been effectively led by a former chemical industry lobbyist. The "Strengthening Transparency in Regulatory Science" proposal, meanwhile, would limit the type of studies IRIS could use, making it harder to determine the real-world impacts of chemicals, Denison warned. "They're looking at the clock and they are trying to make more permanent changes that would be harder to undo or stop applying," he said. "What they really want to do is to alter the fundamental way in which these things are done so that they can apply to anything that EPA does going forward," Denison said. "A new administration that comes in would have to undo these policies, not just revisit individual decisions." But EPA's scramble to rewrite the risk assessment guidelines could leave them legally vulnerable, Goldstein predicted. "The issue is a process one," he said. Key regulatory documents that are updated or created without following established agency processes are vulnerable to challenges under the Administrative Procedure Act. Several Trump administration attempts to reduce regulations on industry have already been tossed out by federal judges, who found they were "arbitrary and capricious." For instance, U.S.

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courts have repeatedly rebuffed the Interior Department's efforts to boost energy development, citing process issues. Still, delaying effective risk assessments might be all the administrator is seeking to do, Goldstein suggested. "I don't know what's guiding Andrew Wheeler," the Reagan-era appointee said. "But he comes out of being a lobbyist for the coal industry and he will someday go back to that type of position. If he gets his rules through that the industry wants and, at some later date, the courts throw them out, he's still a success as far as the people he's responding to are concerned."

Science, 31 May 2019

<http://sciencemag.org/>

### **Gut bacteria may contribute to autism symptoms, mouse study finds**

2019-06-05

Genes are a powerful driver of risk for autism, but some researchers suspect another factor is also at play: the set of bacteria that inhabits the gut. That idea has been controversial, but a new study offers support for this gut-brain link. It reveals that mice develop autism-like behaviours when they are colonised by microbes from the faeces of people with autism. The result doesn't prove that gut bacteria can cause autism. But it suggests that, at least in mice, the makeup of the gut can contribute to some hallmark features of the disorder. "It's quite an encouraging paper," says John Cryan, a neuroscientist at University College Cork in Ireland who was not involved in the research. The idea that metabolites—the molecules produced by bacterial digestion—can influence brain activity "is plausible, it makes sense, and it will help push the field forward." Many studies have found differences between the composition of the gut microbiomes in people with and without autism. But those studies can't determine whether a microbial imbalance is responsible for autism symptoms or is a result of having the condition. To test the effect of the gut microbiome on behaviour, Sarkis Mazmanian, a microbiologist at the California Institute of Technology (Caltech) in Pasadena, and collaborators put faecal samples from children with and without autism into the stomachs of germ-free mice, which had no microbiomes of their own. The researchers then mated pairs of mice colonised with the same microbiomes, so their offspring would be exposed to a set of human microbes early in development. The researchers then ran these offspring through behavioural tests typically used to gauge autism-like symptoms in mice. They recorded how frequently a mouse vocalized and

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how often it approached and interacted with another mouse. They also tried to approximate the repetitive behaviour seen in some people with autism by scattering marbles around a cage and counting how many a mouse buried. Compared with mice colonised with bacteria from children without autism, the mice that inherited a microbiome from a child with autism were less social and showed more repetitive behaviour, the authors report today in *Cell*. Mice with the autism-derived microbiome also had lower levels of several bacterial species that the researchers suspect could be beneficial. It's known that microbes in the gut break down or modify the amino acids in food, and that by-products can travel through the bloodstream and possibly into the brain. But researchers don't know exactly which of the transplanted microbes interact with the brain to influence autism-like symptoms. When the researchers dissected the mouse brains, RNA analysis of the two groups revealed differences in splicing—the way DNA's message is processed before it's translated into a protein—for 560 genes, including 52 that have been associated with autism. That's an intriguing hint that the products of gut microbes might somehow change autism risk by influencing what forms of proteins are made in the brain, says Caltech biologist Gil Sharon, a postdoctoral researcher and first author on the new paper. When the researchers looked at the contents of the mouse guts, they found differences between the two groups in the levels of 27 metabolites. In particular, mice harbouring microbes from people with autism had lower levels of taurine and 5-aminovaleric acid (5AV), molecules that are known to bind to neurons and inhibit their activity. That finding fits with the theory that an imbalance between excitatory and inhibitory signals in the brain might underlie autism. The team also found with a different strain of mouse known to develop autism-like symptoms that feeding the animals either taurine or 5AV led to more social interaction and less repetitive behaviour. "There's still a lot of missing links," says Jun Huh, an immunologist at Harvard University who studies the relationship between bacteria and brain function. "But I think the real importance of this study is to show—for the first time—that there's a causal relationship between the bacterial community and [autism-like] behaviour." Shakuntla Gondalia, a gut microbiome researcher at Swinburne University of Technology in Hawthorne, Australia, says the next step should be to replicate the findings with faecal samples from people outside of the United States. Our resident microbes vary based on our environment and diet, she says, and the possible effect of this variation on autism risk remains a mystery. These results are unlikely to yield new microbiome-based treatments right away, Cryan notes. The two metabolites highlighted in this study might turn out to be irrelevant to autism in people. Still, the research justifies a hunt for

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other metabolites deficient in the gut or brain of people with the disorder, he says. "This will give encouragement to the field that there is something there."

Science, 30 May 2019

<http://sciencemag.org/>

### Penicillin: Discovery, Benefits and Resistance

2019-06-05

Penicillin is a member of a group of antibiotics that are widely used to treat bacterial infections. Before the introduction of antibiotics, there were no effective treatments for infections caused by bacteria, such as pneumonia, tuberculosis, gonorrhoea or rheumatic fever. But the drug's accidental discovery in the late 1920s ushered in a new age of medicine. Penicillin was hailed as a "miracle drug" that could save lives and effectively treat a variety of infectious diseases. Today, there are many natural and synthetic types of penicillin, which are used to treat a wide range of ailments. However, some strains of bacteria have become resistant to penicillin and other antibiotics, making those infections more difficult, and sometimes impossible, to treat.

#### Penicillin invention

Alexander Fleming, a professor of bacteriology in London, is credited with discovering penicillin in 1928. Returning from vacation, he started cleaning up his messy lab and noticed that some petri dishes containing *Staphylococcus* bacteria had been contaminated with a mould, *Penicillium notatum*, which was preventing the normal growth of the bacteria, according to Dr. Howard Markel's column for PBS NewsHour. Fleming obtained an extract from the mould, named its active agent "penicillin" and determined that the extract killed many types of harmful bacteria. "When I woke up just after dawn on September 28, 1928, I certainly didn't plan to revolutionise all medicine by discovering the world's first antibiotic, or bacteria killer. But I guess that was exactly what I did," Fleming later wrote about his discovery. Fleming's lab didn't have the resources to fully develop his discovery into a usable drug. For more than a decade, other scientists tried to purify penicillin but were unsuccessful. Then in 1939, Howard Florey, a pathology professor at Oxford University, read Fleming's paper in the *British Journal of Experimental Pathology*. Florey and his colleagues were able to purify penicillin and test its effectiveness on animals before the first trial with a human. On Feb. 12, 1941, Albert Alexander received the first dose of penicillin, according to the American

**First discovered in the lab in 1928, penicillin was being mass produced and advertised by 1944.**

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Chemical Society (ACS). In just a few days, the treatment began healing Alexander of a life-threatening infection. Unfortunately, Florey's team ran out of the drug before Alexander was completely healed, and he died. A year later, enough penicillin was produced to successfully treat the next patient. Anne Miller, a patient at New Haven Hospital in Connecticut, had a miscarriage and developed an infection that led to blood poisoning. Penicillin administration cleared Miller's infection. During World War II, penicillin was mass-produced and used to treat infections in wounded and ill soldiers. Historically, infections had killed more soldiers at war than battle injuries, Markel wrote. The discovery of penicillin decreased the death rate from bacterial pneumonia in soldiers from 18% to 1%. In 1945, Fleming, Florey and Florey's colleague, Ernst Chain, received the Nobel Prize in physiology or medicine for their discovery of penicillin.

#### How penicillin works

Penicillin is given to patients with an infection caused by bacteria. Some types of bacterial infections that may be treated with penicillin include pneumonia, strep throat, meningitis, syphilis and gonorrhoea, according to the National Library of Medicine. It may also be used to prevent dental infections. As an antibiotic, penicillin kills bacteria or prevents them from growing and multiplying. The drug works by attacking enzymes that build the cell walls of bacteria. Penicillin prevents the bacteria from synthesising peptidoglycan, a molecule in the cell wall that provides the wall with the strength it needs to survive in the human body. The drug greatly weakens the cell wall and causes bacteria to die, allowing a person to recover from a bacterial infection. Different kinds of penicillin are used for various infections. Some types of penicillin are amoxicillin, ampicillin, Augmentin, penicillin G and penicillin V.

#### Side effects of penicillin

Though penicillin has saved many lives, it isn't always helpful for everyone. For example, some people have penicillin allergies that can cause a rash, hives, itching, skin swelling, anaphylaxis (a life-threatening allergic reaction) and other symptoms. Beyond allergies, penicillin is becoming less effective over time, as bacteria have become resistant to the antibiotics designed to kill them. Each year, at least 2 million people in the United States develop a bacterial infection that is resistant to antibiotics and at least 23,000 people die as a result, according to the Centres for Disease Control and Prevention (CDC). The overuse and misuse of antibiotics contribute to the development of antibiotic resistance, according to the Mayo Clinic. Every time a person takes antibiotics, most

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bacteria are killed, but a few drug-resistant bacteria strains are left to grow and multiply. This means that regular antibiotic use may increase the number of drug-resistant bacteria in the body. For this reason, antibiotics should only be used to treat bacterial infections and should not be prescribed for viral infections, such as colds, flu, most sore throats, bronchitis and many types of sinus and ear infections, according to the CDC. Nonetheless, many sore throats and upper respiratory infections that are caused by viruses are often treated with antibiotics because it is a perceived quick fix, said Dr. Saul R. Hymes, medical director for Paediatric Antimicrobial Stewardship at Stony Brook Children's Hospital in New York. "Overall, there is a major problem with inappropriate antibiotic prescribing in the United States," Hymes told Live Science. A 2016 study reported that between 30% and 50% of all antibiotic prescriptions for common conditions such as ear infections, sore throats and other upper respiratory-type infections may have been inappropriate and unnecessary.

Live Science, 30 May 2019

<http://www.livescience.com>

## Technical Notes

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