CHEMWATCH

Bulletin Board

Contents

MAY. 05, 2023

(click on page numbers for links)

CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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

Contents

MAY. 05, 2023

CHEMWATCH
Bulletin Board

Contents

MAY. 05, 2023

ASIA PACIFIC

China tightens rules on personnel responsible for overseeing cosmetics safety

2023-04-20

New regulations in China will mean only experienced personnel can review safety assessment reports and make decisions on cosmetics safety within companies, according to guidance from the National Medical Products Administration (NMPA).

The Regulations on the Supervision and Management of Enterprises to Implement the Main Responsibility of Cosmetic Quality and Safety, which came into force on 1 March, support the implementation of China's overarching cosmetics law.

Read More

Chemical Watch, 20-04-23

https://chemicalwatch.com/729886/china-tightens-rules-on-personnel-responsible-for-overseeing-cosmetics-safety

APVMA releases minor use permits for fungus, weeds

2023-04-24

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has recently issued a number of minor use permits of relevance to grain growers.

Minor use permits are issued by the APVMA to legalise the use of a crop protection product in situations where there is insufficient market size or economic return to attract product registrations. Such instances typically occur with the 'minor' grain crops or for situations of limited area in a major crop, where no registered products exist for the proposed use.

The products relevant to Australian growers for which minor use permits have recently been issued are:

Procymidone (Sumisclex): use of the fungicide procymidone on faba beans (Vicia faba) and navy beans (Phaseolus vulgaris) for the control of chocolate spot and sclerotinia rot. Following a recent APVMA review, this usage was removed from registered labels. Usage has been retained by growers under the minor use permit PER92791 until the identified data gaps are filled, allowing for the uses to be re-established on product labels.

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

Quinoxyfen: use of the fungicide quinoxyfen on wheat for the control of powdery mildew. GRDC and South Australian Grain Industry Trust-supported research has identified several potential fungicides that are more specifically targeted at powdery mildew control. This minor use permit (PER93197) is the first to allow for the use of quinoxyfen in wheat.

Metribuzin: use of the herbicide metribuzin in the metribuzin-tolerant lentil varieties such as GIA Metro is allowed under the minor use permit PER92810. GRDC is investing in field studies to meet the regulatory requirements pertaining to crop safety, efficacy and grain residues in support of the use of metribuzin for this purpose.

Proquinazid (Talendo fungicide): use of the fungicide proquinazid on wheat for the control of powdery mildew. The minor use permit (PER93216) stipulates no more than two applications per crop. Talendo has no curative activity and does not control existing infections – it is for use as a protectant only.

Metrafenone (Vivando fungicide): use of the fungicide metrafenone on wheat for the control of powdery mildew. The minor use permit (PER93198) is in force until 31 July 2024. The fungicide should be applied at the first signs of infection as a protectant only.

Read More

Global Agriculture, 24-04-23

https://www.en.krishakjagat.org/global-agriculture/apvma-releases-minor-use-permits-for-fungus-weeds/

Pre-introduction report: internationally-assessed for human health only

2023-04-26

This guide helps you complete the pre-introduction report online form in AICIS Business Services for the type of reported introduction called 'internationally assessed for human health but not the environment'. This PIR guide draws on information in the IC Act, General Rules and the Industrial Chemicals Categorisation Guidelines to help you categorise your chemical introduction.

Read More

AICIS, 26-04-23

https://www.industrialchemicals.gov.au/business/reporting-and-record-keeping-obligations/pre-introduction-reports-reported-category/pre-introduction-report-internationally-assessed-human-health-only

Chemicals added to the Inventory 5 years after issue of assessment certificate – 26 April 2023

2023-04-26

The following industrial chemicals have been added to the Australian Inventory of Industrial Chemicals in accordance with section 82 of the Industrial Chemicals Act 2019 because 5 years have passed since the assessment certificates for the industrial chemicals were issued.

CAS Number	2905359-75-1
Chemical Name	2-Propenoic acid, 2-methyl-, 2-hydroxyethyl ester, polymer with phenylmethyl 2-methyl-2-propenoate and 2-propenoic acid, potassium salt, 2,2′-(1,2-diazenediyl)bis[2,4-dimethylpentanenitrile]-initiated
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	12 April 2023

CAS Number	2914886-87-4
Chemical Name	Neodecanoic acid, 2-oxiranylmethyl ester, polymer with 1,1-dimethylethyl 2-methyl-2-propenoate, ethenylbenzene, 2-hydroxyethyl 2-methyl-2-propenoate, 2-propenoic acid and rel-(1R,2R,4R)-1,7,7-trimethylbicyclo[2.2.1]hept-2-yl 2-methyl-2-propenoate, OO-(1,1-dimethylpropyl) O-(2-ethylhexyl) carboperoxoate-initiated
Molecular Formula	Unspecified

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

CAS Number	2914886-87-4
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	12 April 2023

CAS Number	105761-40-8
Chemical Name	Dodecanedioic acid, polymer with .alpha.-(2-aminomethylethyl)-.omega.-(2-aminomethylethoxy) poly[oxy(methyl-1,2-ethanediyl)] and azacyclotridecan-2-one
Molecular Formula	(C12H23NO.C12H22O4.(C3H6O)nC6H16N2O)x
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	12 April 2023

CAS Number	2102038-87-7
Chemical Name	2-Propenoic acid, 2-methyl-, polymer with butyl 2-propenoate, cyclohexyl 2-methyl-2-propenoate, ethenylbenzene, 1-propene and 2-propenoic acid, tert-Bu peroxide-initiated
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	12 April 2023

CAS Number	2914158-37-3
Chemical Name	2,5-Furandione, polymer with 1-decene, 2-hydroxyethyl imide, N-octadecylcarbamates (esters)
Molecular Formula	Unspecified

CAS Number	2914158-37-3
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	17 April 2023

CAS Number	475645-84-2
Chemical Name	Cyclosilazanes, di-Me, Me hydrogen, polymers with di-Me, Me hydrogen silazanes, reaction products with 3-(triethoxysilyl)-1-propanamine
Molecular Formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	17 April 2023

CAS Number	87889-51-8
Chemical Name	Butanoic acid, 3-oxo-, 2-[(2-methyl-1-oxo-2-propen-1-yl)oxy]ethyl ester, polymer with butyl 2-propenoate, ethenylbenzene and methyl 2-methyl-2-propenoate
Molecular Formula	(C10H14O5.C8H8.C7H12O2.C5H8O2)x
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	17 April 2023

CAS Number	2062567-96-6
Chemical Name	Phosphonium, tetrakis(hydroxymethyl)-, sulfate (2:1), reaction products with 1-tetradecanamine and urea
Molecular Formula	Unspecified

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

CAS Number	2062567-96-6
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	17 April 2023

Read More

AICIS, 26-04-23

https://www.industrialchemicals.gov.au/news-and-notices/chemicals-added-inventory-5-years-after-issue-assessment-certificate-26-april-2023

India Delays Quality Control Orders for 6 Chemicals

2023-04-26

Six chemicals will require BIS certificates from July and October of 2023.

On March 31, 2023, India's Department of Chemicals and Petro Chemicals issued a Gazette Notification to delay the implementation of Quality Control Orders (QCOs) for six chemicals.

According to the Notification, new implementation date is set out for six chemicals as follows:

Goods or Articles	Title of Indian Standard	Implementation Date
Ethylene Vinyl Acetate Copolymers	IS 13601:1993 Ethylene Vinyl Acetate (EVA) copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drining waster-Specification	October 3, 2023
Polyethylene Material for Moulding and Extrusion	IS 7328:2020 Polyethylene Material for Moulding and Extrusion - Specification	October 3, 2023
Polyester Continuous Filament Fully Drawn Yarn	IS 17261:2022 Textile-Polyester Continuous Filament Fully Drawn Yarns - Specification	July 3, 2023

Goods or Articles	Title of Indian Standard	Implementation Date
Polyester Partially Oriented Yarn	IS 17262:2019 Textile-Polyester Partially Oriented Yarn - Specification	July 3, 2023
Polyester Industrial Yarn	IS 18264:2019 Textile-Polyester Industrial Yarn - Specification	July 3, 2023
100 Percent Polyester Spun Grey and White Yarn	IS 17265:2019 Textile-100 Percent Polyester Spun Grey and White Yarn - Specification	July 3, 2023

The orders shall apply to chemicals for manufacture, import and trade. Each chemical shall conform to the corresponding Indian Standard as specified in the table and be marked with BIS Standard Mark after obtaining BIS product certification license, as specified in Scheme I of Schedule II of the Bureau of Indian Standards (Conformity Assessment) Regulations, 2018.

Read More

Chemlinked, 26-04-23

https://chemical.chemlinked.com/news/chemical-news/india-delays-quality-control-orders-for-six-chemicals

AMERICA

Technical paper: Federal Plastics Registry

2023-04-18

This document outlines the technical details and reporting requirements being considered for the Federal Plastics Registry. The document has taken into account the significant feedback received from partners, stakeholders and the public during consultations. A draft section 46 notice under the Canadian Environmental Protection Act, 1999 (CEPA) is targeted for publication in Canada Gazette, Part I, before the end of 2023, which will be followed by a further consultation period before the instrument is finalized. Partners and stakeholders are invited to review this document and provide feedback before May 18, 2023.

1.1 Background

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

Canadians are concerned about the impact of plastic waste and want concrete action to improve the recycling of plastics and prevent pollution. The Government of Canada is continuing to bring forward new measures to better manage plastic and move towards its goal of zero plastic waste.

On July 25, 2022, the government published a consultation paper that outlined a proposed approach to establishing a federal plastics registry. This was followed by a consultation period that ended October 7, 2022. The government received over 80 written submissions from a diverse range of partners and stakeholders. More information on how the government consulted, and what was heard, can be found in the What we heard report published on the government's website.

1.1.1 Why a federal plastics registry is needed

The registry will serve to improve our knowledge of plastic waste, value recovery, and pollution across Canada. It will provide important information to inform the government on future compliance promotion and enforcement activities and will help to identify gaps in the plastics value chain where further government action may be required. The registry would be a key source of information that the Government of Canada will use to support the implementation and monitoring of different measures that are part of the government's zero plastic waste agenda. A federal plastic registry would standardize the data that is collected on provincial and territorial Extended Producer Responsibility (EPR) programs and provide useful information for stakeholders, government and Canadians. Furthermore, it will support provincial and territorial EPR programs in force or under development, and provide useful baseline data to provinces and territories when expanding EPR into new product categories.

Currently, data requirements for information collected for EPR programs are inconsistent across Canada. Provincial and territorial jurisdictions have different requirements for how performance should be measured, as well as inconsistent tracking and reporting processes. This means EPR programs cannot be compared or verified between jurisdictions or product categories, limiting the ability to measure the performance of EPR across the country. This problem is not limited to one part of Canada, or even to Canada as a whole. For example, some major studies in Canada and internationally have been unable to quantify either the extent to which EPR improves recycling rates or how different models of EPR compare to one another. A key function of the registry would be to make EPR data open and accessible to all Canadians, including researchers.

Read More

Government of Canada, 18-04-23

https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/technical-paper-federal-plastics-registry.html

Chlorocresol

2023-03-31

Information Sheet

This substance was identified for action under the Chemicals Management Plan (CMP).

Timelines

Date	Activity
April 1, 2023	Publication in the Canada Gazette, Part I: Vol. 157, No. 13 of a proposed order adding chlorocresol to Schedule 1 to the Canadian Environmental Protection Act, 1999 and start of 60-day public comment period.
May 22, 2021	Publication of the final screening assessment. The proposed risk management approach was also published for a 60-day public comment period. The related notice was published in the Canada Gazette, Part I: Vol. 155, No. 21.
July 27, 2019	Publication and start of 60-day public comment period on the draft screening assessment and risk management scope. The related notice was published in the Canada Gazette, Part I: Vol. 153, No. 30.

Read More

Government of Canada, 31-03-23

https://www.canada.ca/en/health-canada/services/chemical-substances/chemicals-management-plan-3-substances/chlorocresol.html

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

EPA Will Propose to Prohibit Most Uses of Methylene Chloride under TSCA Section 6(a)

2023-04-26

On April 20, 2023, the U.S. Environmental Protection Agency (EPA) announced the release of a proposed rule under Section 6(a) of the Toxic Substances Control Act (TSCA) that would prohibit most uses of methylene chloride. EPA states that its unreasonable risk determination for methylene chloride was driven by risks associated with workers, occupational non-users (ONU), consumers, and those in close proximity to a consumer use. EPA identified risks for adverse human health effects, including neurotoxicity, liver effects, and cancer from inhalation and dermal exposures to methylene chloride. According to EPA, its proposed risk management rule would "rapidly phase down" manufacturing, processing, and distribution of methylene chloride for all consumer uses and most industrial and commercial uses, most of which would be fully implemented in 15 months. EPA notes that for most of the uses of methylene chloride that it will propose to prohibit, its analysis found that alternative products with similar costs and efficacy to methylene chloride products are generally available. Publication of the proposed rule in the Federal Register will begin a 60-day comment period.

According to the pre-publication version of the proposed rule, pursuant to TSCA Section 6(b), EPA determined that methylene chloride presents an unreasonable risk of injury to health, without consideration of costs or other non-risk factors, including an unreasonable risk to potentially exposed or susceptible subpopulations identified as relevant to the 2020 methylene chloride risk evaluation, under the conditions of use (COU). To address the unreasonable risk, EPA will propose, under TSCA Section 6(a) to:

- Prohibit the manufacture, processing, and distribution of methylene chloride for all consumer use;
- Prohibit most industrial and commercial use of methylene chloride;
- Require a workplace chemical protection program (WCPP), including inhalation exposure concentration limits and related workplace exposure monitoring and exposure controls, for ten conditions of use of methylene chloride (including manufacture; processing as a reactant; laboratory use; industrial or commercial use in aerospace and military paint and coating removal from safety-critical, corrosion-sensitive components by federal agencies and their contractors; industrial or commercial use as a bonding agent for acrylic and

polycarbonate in mission-critical military and space vehicle applications, including in the production of specialty batteries for such by federal agencies and their contractors; and disposal);

- Require recordkeeping and downstream notification requirements for manufacturing, processing, and distribution in commerce of methylene chloride;
- Provide a ten-year time-limited exemption under TSCA Section 6(g) for civilian aviation from the prohibition addressing the use of methylene chloride for paint and coating removal to avoid significant disruptions to critical infrastructure, with conditions for this exemption to include compliance with the WCPP

Read More

JD Supra, 26-04-23

https://www.jdsupra.com/legalnews/epa-will-propose-to-prohibit-most-uses-2243290/

Colombia Enforces GHS Implementation in Workplace

2023-04-27

From April 7, 2023, employers must adopt GHS Rev. 6 for classification, labeling, and SDS preparation of pure chemical and diluted solutions in the workplace.

With the issuance of Resolution 0773/2021 on April 9, 2021, Colombia determines that employers must implement GHS in the workplace. Chemical products should be classified in accordance with the sixth revised edition of the Globally Harmonized System of Classifying and Labeling of Chemicals (GHS Rev. 6), as well as the labeling and Safety Data Sheets (SDS).

As per the Resolution, GHS implementation is scheduled to be carried out as follows:

- From April 7, 2023 for pure chemicals and diluted solutions;
- From April 7, 2024 for mixtures.

The Resolution applies to public and private employers, contractors under the modality of civil, commercial or administrative contracts, among others who handle chemical products in the workplace, whether pure, diluted solutions, or mixtures of these.

Labeling

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

The labeling shall be in Spanish and contain at least the following information:

- Product identification. It must be the same as the one used in the Safety Data Sheet;
- Identification of suppliers, whether they are manufacturers, importers or distributors;
- Hazard pictograms;
- Signal words (danger or warning.

For mixtures or alloys, the labeling must indicate the chemical identity of each component or element that may cause acute toxicity, skin corrosion, serious eye damage, germ cell mutagenicity, carcinogenicity, reproductive toxicity, skin or respiratory sensitization or specific target organ toxicity. For small containers (less than 30ml), the labeling should at least record the name of the product contained and the hazard pictograms.

SDS

SDS should be prepared with the following considerations:

- Prepare in a free format;
- Be available in Spanish;
- Register the local emergency line or toll-free number through a landline or cell phone available 24 hours a day, 7 days a week;
- Be located in a visible and safe place;
- The type of recommended personal protective gear must be indicated, specifying characteristics such as, for example, glove material, filter type, etc.

Confidential Business Information (CBI)

For chemical products that are considered CBI, the names of the substances, the description of their composition in mixtures and the CAS numbers may be omitted. The employer shall guarantee that the use of said product does not compromise the health and safety of workers.

Read More

Chemlinked, 27-04-23

https://chemical.chemlinked.com/news/chemical-news/colombia-enforces-ghs-implementation-in-workplace

California considers regulating consumer products containing microplastics and PPD derivatives

2023-04-27

Safer Consumer Products Program proposes adding two chemical families to the menu of chemicals it may regulate, initiating a public process

SACRAMENTO – State regulators announced plans today for two additions to the list of chemicals that may be regulated under the state's Safer Consumer Products Program (SCP). The California Department of Toxic Substances Control (DTSC) proposes adding two groups of chemicals, microplastics and para-Phenylenediamine (PPD) derivatives, to its Candidate Chemicals List (CCL), based on their reported impacts on human health and the environment. This announcement begins a public process that will help inform a potential regulatory proposal.

Scientific evidence is increasingly showing that tiny particles of plastics, known as microplastics, may harm people or the environment. Once they are released, either directly or from the breakdown of larger plastic items, microplastics persist and move in the environment. In its 2021-2023 Priority Product Work Plan, DTSC named products that release microplastics to the environment as one of five policy priorities. At a November 2021 meeting of DTSC's Green Ribbon Science Panel, speakers affirmed that exposure to microplastics may result in broad and significant negative impacts to human health and the environment.

PPD derivatives are a family of chemicals used in a variety of industrial applications. 6PPD, a member of this family, is widely used in motor vehicle tires to prevent deterioration over time; it is the only PPD derivative currently included on the CCL. A 2020 study showed that exposure to 6PPD from tire and road wear particles kills certain species of salmon while they are attempting to spawn. DTSC is finalizing regulations that will add motor vehicle tires containing 6PPD to its Priority Product List, which will require tire manufacturers to identify and evaluate potential alternatives to 6PPD that ensure tire safety and performance while also preventing harm to salmon and other fish. Adding this chemical class to the CCL will ensure that manufacturers fully evaluate the tradeoffs before switching from 6PPD to another PPD derivative.

This announcement, and public workshops planned for June and July, are part of a public process to help inform a potential regulatory proposal. Regulations that add chemicals to the CCL do not directly create any new requirements. They allow DTSC's SCP Program to select consumer products containing one or more of these chemicals for later evaluation and possible regulation under SCP regulations as a Chemical of Concern in a Priority Product. Manufacturers of a consumer product regulated by SCP must thoroughly evaluate the impacts of a Candidate Chemical before choosing it as a replacement for a Chemical of Concern.

SCP's public process for potentially adding microplastics and PPD derivatives to the CCL is underway, with workshops scheduled for June and July. Anyone wishing to participate and stay up-to-date on program activities should join the SCP e-list or visit the program's webpage.

Links to technical background documents and information on the public workshops can be found hereto view more webinars and presentations. The microplastics Public Workshop will be held on July 27, 2023; the PPD Derivatives Public Workshop will be held in July 2023 (date to be announced).

Read More

California DTSC, 27-04-23

https://dtsc.ca.gov/2023/04/27/news-release_t-03-23/

EPA cites Chemours for exceeding PFAS limits in wastewater

2023-04-27

The US Environmental Protection Agency is going after Chemours to reduce per- and polyfluoroalkyl substances (PFAS) in wastewater regularly discharged into the Ohio River from the company's Washington Works facility near Parkersburg, West Virginia. The agency claims the levels of perfluorooctanoic acid (PFOA) and hexafluoropropylene oxide dimer acid (HFPO-DA), a breakdown product of the PFOA replacement known as GenX, exceed those set in the facility's discharge permit.

The action marks the first time the EPA has used its enforcement authority under the Clean Water Act to target PFAS in wastewater discharges.

Chemours produces fluoropolymers and other fluorinated organic chemicals at the Washington Works site. The company says those products are not harmful to human health. But the fluorinated surfactants used as processing aids to make the chemicals are persistent, bioaccumulative, and toxic to humans and the environment.

Contamination from the former use of PFOA as a processing aid at the Washington Works facility still plagues Chemours, which was spun off from DuPont in 2015. The firm is also facing scrutiny over discharges of HFPO-DA resulting from the use of GenX.

The EPA's order cites numerous dates from September 2018 to March 2023 on which the Chemours facility discharged more PFOA and HFPO-DA than its permit allowed The order also states that Chemours failed to "properly operate and maintain all facilities and systems." According to the order, EPA inspectors found unplugged grates and piping that allowed some waste to escape, as well as rips and tears in bins used to store waste.

The order directs Chemours to test for PFAS in stormwater and effluent discharged from the Washington Works facility and to implement a plan to capture and destroy the problematic chemicals before the wastewater is discharged.

"The Parkersburg community has a long history with this facility and the ever-present threat of PFAS pollution," EPA Mid-Atlantic Regional Administrator Adam Ortiz says in a statement. "This order demonstrates that EPA will take action to safeguard public health and the environment from these dangerous contaminants."

Read More

C&EN, 27-04-23

https://cen.acs.org/environment/persistent-pollutants/EPA-cites-Chemours-exceeding-PFAS/101/web/2023/04?utm_source=LatestNews&utm_medium=LatestNews&utm_campaign=CENRSS

Summary of Findings on DTSC's Information Call-in on Nail Products

2023-04-26

The Department of Toxic Substances Control's (DTSC's) Safer Consumer Products (SCP) Program evaluates consumer products sold or offered for sale in California that may contain one or more Candidate Chemicals (CCs) to determine whether to designate them as Priority Products. CCs are chemicals that have been identified to have the potential to cause adverse impacts to human health or the environment. Priority Products are consumer products that contain one or more CCs and have been formally listed in the California Code of Regulations through rulemaking.

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

DTSC's goal is to advance the design, development, and use of products that are safer for people and the environment. To accomplish this goal, DTSC has been evaluating nail products for more than ten years based on concerns that nail salon workers, salon patrons, and nail product consumers – including women of childbearing age and pregnant women – may be exposed to harmful chemicals in nail products and may experience significant adverse health impacts. As part of this effort, in 2020, DTSC conducted an information call-in request from nail product stakeholders to gather information on chemicals that are used as ingredients in nail products. This report summarizes the information reported to DTSC by those nail product stakeholders that responded to the information call-in request. Only 33 of the 186 stakeholders responded to DTSC's request, and two of those responders indicated that they did not have the information requested. DTSC has a limited enforcement authority on stakeholders that are contacted for an information call-in request. Therefore, the response rate was low for this information call-in request from nail product stakeholders. Due to the low response rate, the information in this report may not represent all nail products being sold or offered for sale in California. Data is presented in an aggregated form in this report to protect confidential business information regarding specific nail product formulations.

Read More

California Environmental Protection Agency, 26-04-23

https://dtsc.ca.gov/wp-content/uploads/sites/31/2023/03/DTSCs-Nail-Products-Information-Call-in-Report_Final-Accessible.pdf?emrc=cd8a92

EUROPE

EU plan to ban up to 7,000 dangerous chemicals failing badly, says study

2023-04-25

Roadmap to stop use of substances including 'forever chemicals' used to implement bans on 14 chemical groups so far, report states

A plan to ban up to 7,000 of the most potentially dangerous chemicals on the European market by 2030 is failing badly, according to a study.

A year ago, the EU launched a roadmap to banning groups of toxic substances linked to environmental damage and serious illnesses such

as cancers, hormonal disruption and reprotoxic disorders. These included all bisphenols, the most dangerous flame retardants, and the increasingly controversial PFAS chemicals (per- and polyfluoroalkyl substances).

Also known as "forever chemicals", PFAS formulations accumulate in the natural environment where they take hundreds of years – or longer – to degrade. They were used so ubiquitously over the last century that one US government study found them in the bloodstreams of almost all Americans, while a survey this year logged 17,000 contaminated sites in Europe - and 2,100 hotspots.

The restrictions roadmap was brought in as an interim measure to protect the public and nature while the European Commission finalises an update to its complex Reach programme (which centrally compiles data on modern synthetic chemicals, and sets rules for their governance).

But Reach has been delayed and the commission has so far used the roadmap to implement bans on just 14 chemical groups, of which only two appear watertight, according to a joint report by the green law group ClientEarth and the European Environmental Bureau.

Hélène Duguy, ClientEarth's law and policy adviser, said lagging action showed "the failure of the EU's piecemeal approach to chemical bans. This approach means that people and our environment are not protected against the most harmful chemicals. This needs to change now. European authorities and the EU commission have all legal tools to rescue this roadmap and correct a depressing direction of travel."

Read More

The Guardian, 25-04-23

https://www.theguardian.com/environment/2023/apr/25/eu-plan-to-ban-up-to-7000-dangerous-chemicals-failing-badly-says-study

European Green Deal: new law agreed to cut aviation emissions by promoting sustainable aviation fuels

2023-04-26

The Commission welcomes the political agreement on the ReFuelEU Aviation proposal, reached yesterday between the European Parliament and the Council. Once in place, the new rules will help decarbonise the aviation sector by requiring fuel suppliers to blend sustainable aviation fuels (SAF) with kerosene in increasing amounts from 2025.

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

This measure on its own is projected to reduce aircraft CO2 emissions by around two-thirds by 2050 compared to a 'no action' scenario, and provide climate and air quality benefits by reducing non-CO2 emissions.

The deal marks the last agreement on the transport proposals within the 'Fit for 55' package, as agreements on updated rules on emissions trading in the aviation sector and in the maritime sector, on promoting sustainable fuels for shipping, as well as on the accelerated deployment of alternative fuels infrastructure, were already reached.

Increasing amounts of sustainable aviation fuels

The new rules will require:

1) Aviation fuel suppliers to supply a minimum share of SAF at EU airports, starting at 2% of overall fuel supplied by 2025 and reaching 70% by 2050. The new EU jet fuel blend will need to also contain a minimum share of the most modern and environmentally-friendly synthetic fuels, which increases over time;

2) Aircraft operators departing from EU airports to refuel only with the fuel necessary for the flight, to avoid emissions related to extra weight or carbon leakage caused by 'tankering' practices (deliberately carrying excess fuel to avoid refuelling with SAF);

3) Airports to ensure that their fuelling infrastructure is available and fit for SAF distribution.

Read More

European Commission, 26-04-23

https://ec.europa.eu/commission/presscorner/detail/en/ip_23_2389

Commission updates marketing standards of agri-food products to better address consumer needs and sustainability

2023-04-21

Today, the Commission proposed to revise the existing marketing standards applicable to a number of agri-food products, such as fruit and vegetables, fruit juices and jams, honey, poultry or eggs. The proposed revisions should help consumers make more informed choices for a healthier diet and contribute to prevent food waste.

The Commission put forward the following proposals, among others:

- Origin labelling: Clearer, mandatory origin labelling rules for honey, nuts and dried fruits, ripened bananas, as well as trimmed, processed and cut fruit and vegetables (such as packaged salad leaves). The country, or countries of origin in case of blends or mixes, will have to appear on the label. Listing the countries of origin will increase the transparency for consumers. This should also promote EU production of these products.
- Food waste: The proposed revisions address food waste and packaging waste. For example, so-called "ugly" fruit and vegetables (with external defects but still suitable for local/direct consumption) sold locally and directly by producers to consumers would be exempted from complying with marketing standards. Valorising them in their "fresh" state could offer consumers more opportunities to buy fresh fruit and vegetables at more affordable prices and benefit producers active in short supply chains. Certain products affected by natural disasters or other exceptional circumstances may also be sold if safe to consume.
- Packaging: Products intended for donation may be exempted from main labelling requirements. This will reduce red tape and labels and, therefore, facilitate operators' engagements in donations.
- Fruit juices: it will be possible for fruit juices to bear the mention "with no added sugars" to clarify that, contrary to fruit nectars, fruit juices cannot by definition contain added sugars – a feature that most of the consumers are not aware of. Moreover, to address the growing consumer demand for products with lower sugar content, a reformulated fruit juice would be allowed to indicate "reduced-sugar fruit juice" on its label. To simplify further and adapt to consumer tastes, the term "coconut water" could now be used alongside "coconut juice".

Read More

European Commission, 21-04-23

https://ec.europa.eu/commission/presscorner/detail/en/ip_23_2366

CHEMWATCH
Bulletin Board
Regulatory Update
MAY. 05, 2023

Current calls for comments and evidence

2023-04-27

Calls for comments and evidence allow interested parties to signal their interest and express their views and concerns in the preparatory phase of the restriction proposal. They also let interested parties comment on the different documents under preparation in ECHA in relation to restrictions, such as reports on substances in articles and guidelines on restriction entries.

Additional information to justify or support comments made is also welcomed. The information gathered will provide an input into developing Annex XV restriction dossiers or other documents. When we open a call for comments and evidence, we intend to give parties who otherwise might not have been identified and consulted a chance to submit information.

The calls for comments and evidence do not take the place of the public consultation on restriction proposals developed by Member States or ECHA, which forms a standard part of the restriction process.

Consultations close at 23:59 Helsinki time.

Current calls for comments and evidence

CHEMWATCH
Bulletin Board
REACH Update
MAY. 05, 2023

Name	EC Number	CAS Number	Start of consul-tation	Deadline for providing input	Subject of the call
1,4-dioxane	204-661-8	123-91-1	20/04/2023	20/06/2023	Call for evidence on 1,4-dioxane as well as substances and mixtures containing 1,4-dioxane as a constituent or an impurity

Read More

ECHA, 27-04-23

https://echa.europa.eu/calls-for-comments-and-evidence

Janet's Corner

MAY. 05, 2023

Safety Data Sheets

2023-05-05

twitter.com/ErrantScience/status/1634164847830073346

Hazard Alert

MAY. 05, 2023

Arsenic

2023-05-05

Arsenic is a chemical element with the symbol As, an atomic mass of 74.921 595, and an atomic number of 33. It is in the pnictogens group of the periodic table and its element category is Metalloid. Arsenic has a metallic grey appearance and is primarily used in alloys of lead. Its multiple allotropes come in a variety of colours—including yellow and black—but only the grey form is important to industry. Arsenic is found in many minerals, usually in combination with metals sulfur, but it can also present as a pure elemental crystal. Arsenic is both an organic and inorganic chemical. It is a Group-A carcinogen and all forms of the element are a serious risk to human health. [1, 2]

USES [1,2]

Arsenic is primarily used for strengthening alloys of lead and copper for use in car batteries or ammunition. While once a popular component in the production of pesticides, herbicides and insecticides, the use of arsenic is declining due to toxicity of the chemical. Arsenic is also used as an n-type dopant in semi conductive electronic devices. Some species of bacteria use arsenic compounds as respiratory metabolites, and trace elements of the chemical are essential in the diets of rats, hamsters, goats and chickens. There is no known role for arsenic in human metabolism—however, arsenic contamination of groundwater affects millions of people across the globe.

Arsenic is a chemical element with the symbol As, an atomic mass of 74.921 595, and an atomic number of 33.

ROUTES OF EXPOSURE [3]

- People can be exposed to arsenic by skin contact, inhaling it, or by consuming contaminated food, water or other drinks.
- Humans are normally exposed to trace amounts of arsenic in the air, water and foods they consume.
- Higher levels of arsenic may be found in industrial areas that currently or previously contained arsenic.
- Drinking water that is associated with high levels of arsenic is known as an area of high exposure.

HEALTH EFFECTS

Arsenic poisoning can be a result of organic or inorganic arsenic, and it affects a range of systems including the skin, nervous, respiratory and cardiovascular systems.

Acute Effects [4]

Severity of symptoms depend on the level and type of exposure. Accute effects are the result of short-term exposure by high concentrations of arsenic.

- If the arsenic is inhaled, pulmonary oedema, dyspnoea and muscous membrane irritation may occur.
- If swallowed, arsenic can cause severe vomiting and abdominal pain within the first one to two hours.
- Cardiovascular effects include vasodilation, cardiac depression and cardiac shock.
- Symptoms of CNS and PNS effects include: headache, coma, convulsions, cerebral oedema and/or sensory loss.
- Arsenic poisoning can also result in anaemic, leukopaenia and hepatic toxicity.

Chronic Effects [4]

Arsenic is toxic to multiple body systems. Long-term exposure to the element can cause skin changes (new lesions, redness, swelling, darkening or discolouration and hyperkeratosis—bumps in the skin that resemble warts), and persistent digestive issues, including problems with liver and kidney function. It has also been linked to causing conjunctivitis, loss of appetite, weakness, motor paralysis and bone marrow depression with pancytopaenia. Chronic arsenic exposure has been linked to the development of certain cancers, including that of the kindey, lung, skin and bladder. Long-term symptoms can be present 5 years after exposure. Inorganic arsenic compounds are more toxic than its organic counterparts.

SAFETY

First Aid Measures [5]

- Ingestion: If ingested, rinse mouth and DO NOT induce vomiting. Arsenic is fatal if swallowed. Immediately call a doctor or a poison centre.

CHEMWATCH
Bulletin Board
Hazard Alert
MAY. 05, 2023

- Skin contact: In case of skin or hair contact, remove/take off all contamination clothing immediately and thoroughly rinse with water. Immediately call a doctor or poision centre.
- Eye contact: Flush eyes carefully with water for several minutes. Check for and remove contact lenses if easy to do so. Continue rinsing.
- Inhaled: Take contaminated person to nearest fresh air source and monitor their breathing.
- General: Never administer anything by mouth to an unconscious, exposed person.

Exposure Controls/Personal Protection [5]

- Engineering controls: Safety showers and emergency eyewash fountains should be accessible in the immediate area of the potential exposure. Ensure there is adequate ventilation. Whenver possible, material should be handled in a laboratory.
- Personal protection: Safety glasses, protective and dustproof clothing, gloves and a combined gas/dust mask with a B/P3 filter.

REGULATION [6]

United States:

Agency	Level
ACGIH (American Conference of Governmental Industrial Hygienists)	10 micrograms/m^3
NIOSH (National Institute for Occupational Safety and Health)	2 micrograms/m^3
OSHA (Occupational Safety and Health Administration)	10 micrograms/m^3
EPA (Environmental Protection Agency)	10 parts per billion
FDA (Food and Drug Administration)	0.5-2 parts per million

Australia [4]

Safe Work Australia: Safe Work Australia has set an 8-hour time weighted average (TWA) concentration for arsenic of 0.05mg/m^3. However, it should be noted that the TWA values are likely to be higher than the biological standards exposure level for the chemical; therefore, all reasonable steps must be taken to minimise the level of exposure to a level well below the workplace standard.

REFERENCES

1. https://en.wikipedia.org/wiki/Arsenic#Exposure
2. https://wanttoknowit.com/uses-of-arsenic/
3. https://www.medicinenet.com/arsenic_poisoning/article.htm#what_are_the_symptoms_of_arsenic_poisoning
4. https://www.safeworkaustralia.gov.au/system/files/documents/2002/health_monitoring_guidance_-_arsenic.pdf
5. http://www.labchem.com/tools/msds/msds/LC11505.pdf
6. https://www.atsdr.cdc.gov/csem/csem.asp?csem=1&po=8

CHEMWATCH
Bulletin Board

Grad student helps design 'artificial muscles' you can toss in the compost bin

2023-04-23

Say "hello" to the robots of the future: They're soft and flexible enough to bounce off walls or squeeze into tight spaces. And when you're done with them, you can toss these machines into a compost bin to decompose.

That's the vision of a team of engineers, including CU Boulder graduate student Ellen Rumley. In a paper published last month in the journal Science Advances, the researchers described their designs for a new kind of robotic actuators, or "artificial muscles." The group's actuators, which work by shifting fluid around in squishy sacs, can power robotic arms and legs with life-like movements. They also dissolve naturally in soil over a period of a few months, making them much more sustainable than previous models.

"You could dispose of them in an industrial compost bin," said Rumley, co-first author of the new study and researcher in the Paul M. Rady Department of Mechanical Engineering at CU Boulder. "We hope the project will inspire other engineers to develop robotics with sustainability in mind."

Think Baymax, the pillowy robot from the film Big Hero 6, mixed with a biodegradable grocery bag.

The project emerged from a long-running effort led by Christoph Keplinger, formerly an assistant professor of mechanical engineering at CU Boulder and now director at the Max Planck Institute for Intelligent Systems in Stuttgart, Germany. In 2018, he and his colleagues debuted a line of artificial muscles they call Hydraulically Amplified Self-Healing ELectrostatic (HASEL) actuators. Like human muscles, these actuators can bend robotic arms like a bicep or squeeze claws and grippers.

But what they couldn't do, until now, was disappear in a landfill.

In the new study, the team developed a series of soft robotic actuators entirely made of sustainable ingredients. The muscles are about as versatile as traditional HASEL actuators and, in some cases, can flex for 100,000 cycles or more without breaking.

"It was particularly exciting that we ended up with a materials system that is fully biodegradable and can still match key performance metrics of actuators made from non-biodegradable materials," said Keplinger, co-

Think Baymax, the pillowy robot from the film Big Hero 6, mixed with a biodegradable grocery bag.

founder of Artimus Robotics, a Boulder-based company that develops and sells HASEL actuators.

"The sustainability of the new materials system now opens up very interesting avenues for applications that require components designed for single- or short-term use, for example, in the area of food handling or medical applications."

Artificial muscles for robots

Rumley's own search for a different kind of robot goes back years. As a high school student in Anchorage, Alaska, Rumley belonged to a robotics club where she learned to design robots for FIRST Tech Challenge competitions. She could never get over the inelegance of hard robots made from metal and plastic.

"I had felt like the rigidity of the robots was a big limiting factor of their physical capabilities," said Rumley, who started her graduate studies in Boulder before moving to Germany in 2020 to work as a visiting researcher in Keplinger's lab. "That was especially jarring when you saw a person walking next to a robot."

Soft robots, however, could potentially solve those issues by combining advances in engineering with the squishiness and flexibility of biological organisms.

HASEL actuators are made up of transformer oil inside plastic pouches, which are partially covered by a thin layer of an electrical conductor. If you apply electricity across the conductors, the pouch will "zip together," Rumley said, squeezing the fluid from one end to the other. As a result, the pouches change shape and can apply force to devices like a robotic limb.

Keplinger helped found Artimus Robotics to commercialize the actuators in 2018 alongside Tim Morrissey, Eric Acome, Shane Mitchell and Nick Kellaris with support from Venture Partners at CU Boulder. Kellaris, who earned his doctorate from CU Boulder in materials science and engineering in 2020, was also a co-author of the new paper.

In the new study, Rumley and her colleagues set out to identify sustainable components that could replace every bit of those early designs.

"We were in search of the perfect combination of compatible materials that would make for a high-performance biodegradable muscle," she said.

As part of a systematic and extensive materials science effort, Rumley and her colleagues tested various biodegradable candidates for replacing

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

the plastic pouches in their actuators. One good option, a biodegradable polyester blend, is commonly used in shopping bags and even came stamped with images of carrots.

The team's final designs for artificial muscles can lift nearly as well as ordinary HASEL actuators and will degrade in a composting facility in about 6 months.

Robots of the future

Rumley, a 2020 recipient of the U.S. National Science Foundation's Graduate Research Fellowship, will earn her doctorate degree from CU Boulder but will spend the rest of her time as a student in Europe. There, she's learned to speak a little German and enjoys international life, though she sometimes pines for the wide-open landscapes of Colorado and Alaska.

"I miss wading into a river and catching a salmon," she said. "This isn't big in Germany."

But the engineer says it's worth it to be part of a team of researchers helping to usher in a new era of robotics. Keplinger, for example, has imagined that HASEL actuators could one day power Iron Man-like "exosuits" that could help people who are paralyzed to walk.

"The applications are really exciting, especially for devices that can assist folks who are physically impaired," Rumley said. "I am motivated to develop technology capable of empowering underserved populations."

Tech Xplore, 23 April 2023

https://techxplore.com

Common firefighting chemicals severely hurt Aussie frog, says study

2023-04-25

A new study has found that two commonly used bushfire fighting chemicals – who both markets themselves as environmentally friendly – can kill frogs or severely damage tadpoles' development.

Although these chemicals are have recently replaced foams containing per- and poly-fluoroalkyl substances (PFASs) – more commonly known as forever chemicals – this new research shows there's still issues with wildlife.

The team found that both chemicals (in high or low concentrations) reduced tadpoles' growth.

"There are currently around 15 fire retardants, 15 class A foams and 11 water enhancer formulations approved for bushfire management in Australia," Griffith University ecotoxicologist Dr Chantal Lanctôt told Cosmos Science.

"We currently know very little about the effects of these formulations on most Australian aquatic taxa, including frogs."

Researchers from Griffith University in Queensland looked at two firefighting chemicals – Phos-Chek LC95W and BlazeTamer380.

In 2022, Phos-Chek LC-95A was the most used fire retardant in the world. The product is marketed by retailers as "environmentally friendly", and while Phos-Chek suggests that environmental precautions should be taken, "including preventing entry to sewers and public waters," it also claims: "They are the safest, most effective, and environmentally friendly products available."

BLAZETAMER380 has marketed itself as "non-toxic, non-corrosive and environmentally safe" as well as "proven harmless to humans, animals and vegetation". It's safety data sheet under "ecotoxicity" says: "Anionic polyacrylamide has no systemic toxicity to aquatic organisms or micro-organisms."

The direct application of these chemicals into aquatic systems is prohibited, but according to the researchers "the contamination of aquatic habitats can occur through runoff, spills, dumping, or the unintentional application of firefighting chemicals over small waterbodies."

The researchers looked at one specific Australian frog – the striped marsh frog (Limodynastes peronii).

They exposed 60 striped marsh frog tadpoles to either a control (no chemicals), or between 0.05 and 1 gram per litre of the firefighting solutions for 16 days. This was classed as either 'high' or 'low' exposure to the chemicals.

The team found that both chemicals (in high or low concentrations) reduced tadpoles' growth.

Growth for tadpoles exposed to BlazeTamer were 1.8 to 4.8 times lower compared to the controls, while both low and high Phos-Chek dilutions completely halted tadpole growth and development.

High concentration of Phos-Chek actually caused the death of most of the tadpoles in the experiment, with only 8% surviving the entire 16 days.

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

"We found that both formulations significantly delayed tadpole growth and development," Lanctôt told Cosmos Science.

"Overall, our results show that application of the chemicals in and around small waterbodies (either via deliberate application, runoff or accidental spills) may have important ramifications for amphibians that breed and develop in these habitats."

The chemicals can be used to build fire breaks in advance of fires, as well as dousing bushfires. Phos-Chek is used for deployment ahead of fires, while BlazeTamer is used as a fire suppressant during an active fire.

Although the researchers have only done this on one type of frog, the team think it's 'highly possible' that other species of frogs will be affected in similar ways. The work is ongoing.

Of course, without these firefighting chemicals, many animals – including frogs – would be at risk from bushfires. However, finding chemicals that are both effective at stopping fires and not harmful for the animals they're trying to protect is also important.

"Frogs are of particular concern because they're subject to multiple threats. They are the fastest declining group of vertebrate animals globally, at least partly due to a disease caused by frog chytrid fungus," Lanctôt told Cosmos Science.

"Understanding the impacts of these chemicals on Australian frogs, especially those already threatened by disease, will help inform adaptive management and conservation efforts to protect frogs threatened by disease and bushfires from extinction." The research has been published in Aquatic Toxicology.

Cosmos, 25 April 2023

https://cosmosmagazine.com

In a big step forward, lab-grown meat gets a key ingredient: 3D Fat.

2023-04-21

Researchers have produced lab-grown fat with the texture and potential flavors of the real thing—and crucially, in a way that could be quickly scaled up for the cultured meat industry.

To date, research has focused on producing muscle fibers. This new discovery moves us closer to cultured meat that is actually a delicious and viable alternative to animal slaughter.

This marks a significant step forward in the production of lab-cultured meat alternatives. So far, relevant research has mainly focused on the production of muscle fibers. But without the fat component, meat products have half the flavor, and a completely different mouth feel. A lack of lab-grown fat is also why most cultured meat products in development have amorphous processed form, such as a patty or a chicken nugget, rather than a cut of steak: without fat, it's been difficult to mimic the complex structure of meat in its natural state.

But the researchers on the new eLife study have innovated a way around this.

To start with, they isolated fat cells from mice (as a control) and pigs, and cultured them in a growing medium within a petri dish. This is the usual method of artificially making fat cells. But, it has limitations. With this approach cells can only be grown in extremely thin, 2-dimensional layers that aren't useful for the production of real meat analogs like a chunky steak.

And yet, growing fat cells any thicker means that the oxygen and nutrients contained in the growth medium can't diffuse right through to nourish them all, leaving many to die off. (In bodies, this problem is solved by vast networks of capillaries that reach out and intertwine with the fat matrix to nourish each cell.)

To get around this, the researchers needed to build 3D structures out of their cell cultures. So, once their thin layers of fat cells were fully grown, they took a tiny spatula and scraped them up into dense balls. Yet this claggy mass of fat wasn't quite good enough: it did't have the qualities to generate the right texture. To try and achieve that, the researchers took the harvested fat cells and mixed them together with an edible binding agent that would give some buoyancy to the fat. They tried out two varieties: one called microbial transglutaminase, a type of bacterial enzyme; and another called sodium alginate that is derived from seaweed.

They combined these ingredients in a mold to give the fat a realistic density, and then applied pressure to the samples to test their resistance. This was a useful gauge of how well the cultured fat would hold up between a set of grinding teeth, and also what its mouthfeel would be.

The test revealed that the sodium alginate-infused fat samples especially were more resilient to pressure, and in fact had a similar bounciness and texture to regular animal fat. This was a promising start.

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

But to be truly convincing, cultured fat must also contain a diversity of fatty acids, because when cooked, this variety is what creates the uniquely rich flavors and aromas of regular meat. A molecular profile of the samples revealed that the cultured pork fat in particular was a relatively close match for the fatty acids in real pork fat. The researchers also speculate that including a greater range of fatty acids in the growth medium during the culturing stage could bring this profile closer to the real thing—generating artificial fat that's more flavorful.

The highly-controlled nature of the fat culturing could allow researchers to change the recipe and tweak texture and taste in the future. But for now the major boon is that because of the relatively simplicity of this production method, it can make cultured fat cheaply, and in bulk. With the addition of industrial bioreactors, it becomes highly scalable, the researchers say.

While it's still years away, this all moves us closer to the reality of cultured meat that might be a delicious and viable alternative to the real thing. "Taken together, these approaches offer a potential path to producing meat (or realistic meat alternatives) without animal slaughter, while potentially being more sustainable than conventional meat production," the researchers write.

Anthropocene, 21 April 2023

https://anthropocenemagazine.org

New Study: Common Artificial Sweetener Has an "Unexpected Effect" on the Immune System

2023-04-27

Researchers at the Francis Crick Institute have discovered that consuming large amounts of the commonly used artificial sweetener, sucralose, decreases the activation of T-cells, a crucial aspect of the immune system, in mice.

If similar effects are observed in humans, sucralose could potentially be utilized as a therapeutic agent to suppress T-cell responses. This could be beneficial for individuals with autoimmune diseases who suffer from uncontrolled T-cell activation.

Sucralose is an artificial sweetener, about 600 times sweeter than sugar, that is commonly used in drinks and food. Like many other artificial sweeteners, the effects of sucralose on the body are not yet fully

Scientists discovered that high consumption of sucralose, a common artificial sweetener, lowers T-cell activation in mice, a crucial component of the immune system.

understood, although recent studies have shown that sucralose can impact human health by affecting the microbiome.

In their study, funded by Cancer Research UK and recently published in the journal Nature, the researchers tested the impact of sucralose on the immune system in mice.

Mice were fed sucralose at levels equivalent to the acceptable daily intake recommended by the European and American food safety authorities. Importantly, while these doses are achievable, they would not normally be reached by people simply consuming food or drinks containing sweeteners as part of a normal diet.

The mice fed diets containing high doses of sucralose were less able to activate T cells in response to cancer or infection. No effect was seen on other types of immune cells.

By studying T cells in more detail, the researchers found that a high dose of sucralose impacted intracellular calcium release in response to stimulation, and therefore dampened T -cell function.

This research should not sound alarm bells for those wanting to ensure they have a healthy immune system or recover from disease, as humans consuming normal or even moderately elevated levels of sucralose would not be exposed to the levels achieved in this study.

Instead, the researchers hope the findings could lead to a new way of using much higher therapeutic doses of sucralose in patients, building on the observation that when mice with T cell-mediated autoimmune disease were given a high-dose sucralose diet, this helped to mitigate the harmful effects of their overactive T cells.

Karen Vousden, senior author and principal group leader at the Crick, says: "We're hoping to piece together a bigger picture of the effects of diet on health and disease, so that one day we can advise on diets that are best suited to individual patients, or find elements of our diet that doctors can exploit for treatment.

"More research and studies are needed to see whether these effects of sucralose in mice can be reproduced in humans. If these initial findings hold up in people, they could one day offer a way to limit some of the harmful effects of autoimmune conditions."

Fabio Zani, co-first author and postdoctoral training fellow at the Crick, adds: "We do not want people to take away the message that sucralose

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

is harmful if consumed in the course of a normal balanced diet, as the doses we used in mice would be very hard to achieve without medical intervention.

"The impact on the immune system we observed seems reversible and we believe it may be worth studying if sucralose could be used to ameliorate conditions such as autoimmunity, especially in combinational therapies."

Julianna Blagih, co-first author and former postdoctoral training fellow at the Crick (now Assistant Professor at the Maisonneuve-Rosemont Hospital Research Centre, University of Montreal), explains: "We've shown that a commonly used sweetener, sucralose, is not a completely inert molecule and we have uncovered an unexpected effect on the immune system. We are keen to explore whether there are other cell types or processes that are similarly affected by this sweetener."

Karis Betts, senior health information manager at Cancer Research UK, said: "This study begins to explore how high doses of sucralose could potentially be used in new treatment options for patients, but it's still early days.

"The results of this study don't show harmful effects of sucralose for humans so you don't need to think about changing your diet to avoid it."

The researchers are continuing this work and are hoping to run trials to test if sucralose has a similar effect in humans.

Sci Tech Daily, 27 April 2023

https://scitechdaily.com

Injectable synthetic blood clots stop internal bleeding to save lives

2023-04-26

Scientists at MIT have developed a synthetic system that can stem internal bleeding, to help more people survive long enough to reach a hospital after a traumatic injury. Two components come together at the wound to form a clot, without doing so elsewhere in the body where it might be dangerous.

Traumatic events like car crashes can cause internal bleeding, and if patients don't reach a hospital in time they can be fatal. Finding ways to stop the bleeding can extend that window, potentially saving lives.

Traumatic events like car crashes can cause internal bleeding, and if patients don't reach a hospital in time they can be fatal.

The MIT team has now developed a synthetic system that could be injected by first responders to stem internal bleeding. It does so using nanoparticles and polymers that work to boost the formation of natural blood clots.

Normally, cells called platelets are attracted to the site of a wound, where they trigger a cascade of processes that form a sticky clot. A protein called fibrinogen is also important for maintaining the structure of these clots.

The new system is made up of two major components – nanoparticles that recruit platelets, and a polymer that mimics fibrinogen. The nanoparticles are made of a biocompatible material called PEG-PLGA, and have a peptide that helps them bind to activated platelets. This means that they accumulate where there are higher concentrations of platelets, such as wounds, and work to draw even more to the area. The size of these nanoparticles has also been optimized to be between 140 and 220 nanometers, which keeps them from building up in organs like the lungs where clots can be dangerous.

Importantly, the team also created a crosslinker system, with a chemical group on the nanoparticles that binds to a tag on the fibrinogen-mimicking protein. This helps the two components in the synthetic clotting system find each other at the site of a wound and plug it up more efficiently.

"The idea is that with both of these components circulating inside the bloodstream, if there is a wound site, the targeting component will start accumulating at the wound site and also bind the crosslinker," said Celestine Hong, lead author of the study. "When both components are at high concentration, you get more cross-linking, and they begin forming that glue and helping the clotting process."

The team tested the system in mouse models of internal bleeding, and found that the system with two components worked about twice as well as a version containing just the platelet-recruiting nanoparticles. No significant immune reaction was seen either.

Of course, animal studies don't always translate to humans, so there's still plenty of work left to do before this could be used in the clinic, if ever. But it's an intriguing technique that could one day save lives in emergency rooms or the battlefield.

New Atlas, 26 April 2023

https://newatlas.com

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

New molecular membranes could slash costs for storing green energy

2023-04-26

New technology promises to dramatically improve the performance of batteries, fuel cells, and the electrolyzers that make green hydrogen and other fuels from electricity. The advance—used in a type of "flow battery" that's becoming common for storing renewable energy—boosted the speed at which the battery could provide power fivefold. That jump in performance could sharply reduce the cost of storing green energy for use on the grid, making it easier for societies to completely shift from fossil fuels to renewables.

"This is really an exciting development," says Michael Aziz, a flow battery expert at Harvard University. Young Moo Lee, an electrochemist at Hanyang University, agrees and says the benefits could be widespread. "It could apply for other devices as well." Neither was involved in the new work.

Ability to let certain ions pass with near-zero friction could vastly improve batteries, fuel cells, and other electro-chemical devices

At their core, batteries, fuel cells, and other electrochemical devices look similar. They typically harbor two electrodes separated from one another by a membrane that regulates the flow of charge-carrying ions back and forth through a fluid electrolyte. When these devices charge or discharge, electrons travel through an external wire, and charge-carrying ions pass through the membrane from one electrode to the other to balance out the electrical charges. The membrane plays a critical role, acting as a molecular gatekeeper to allow only certain ions through and block all others. But in practice, these gatekeepers are often too zealous, slowing the passage of ions they are meant to let sail through, which saps device performance.

In a version of flow batteries called aqueous organic redox flow batteries, for example, the membranes must allow positively charged potassium ions to pass back and forth between the two sides of the membrane, while blocking the passage of organic compounds that could kill the battery's operation. Traditional membranes made from organic polymers do a decent job of ensuring that only potassium ions move back and forth. But the polymers in these membranes tend to continuously jiggle around, bumping into the ions and slowing their passage.

To get around this, researchers led by Zhengjin Yang, a chemist at the University of Science and Technology of China, manufactured a series of membranes from a polymer known as a triazine framework. The polymer is able to assemble into a rigid scaffold riddled with tiny pores that are small

enough to exclude all but water molecules and the smallest ions from passing through. Having the water molecules around is good, as they help charged ions slip through the pores.

To speed this transport even more, Yang and his team also modified their triazine starting materials so that the rigid pores were lined with negatively charged sulfonate groups. These groups act like a molecular bucket brigade to grab positively charged potassium ions and quickly pass them to the next tethered sulfonate in line, helping the ions zip through the membrane virtually unimpeded.

When the researchers, including colleagues from the United Kingdom and Germany, then used the best iteration of their new membrane to make an aqueous organic redox flow battery, the more slippery ion flow enabled the batteries to discharge and charge five times faster than similar batteries with a traditional membrane, they report today in Nature.

"We've been hoping for a significant improvement in membranes for flow batteries," says Aziz, who previously served as Yang's postdoctoral adviser. "This looks like it could be it."

However, the new membranes still have a way to go to prove themselves durable and reliable enough for industrial use, says Michael Guiver, a chemist at Tianjin University. And Lee notes that although the chemistry of the triazine compounds makes them ideally suited for working in water, they may not hold up to acidic or alkaline electrolytes used in other electrochemical devices. Nevertheless, he says, other researchers should be able to adopt the same principles to design membranes for other uses, and thereby improve the performance of a wide array of green energy technologies.

That means the new membranes likely won't show up first in consumer products, such as cellphone batteries. But the advance could help tackle one of the biggest concerns about society's switch to renewable energy, namely providing energy when the Sun isn't shining, and the winds are calm. Cheaper, more efficient membranes mean smaller, cheaper batteries can store the same amount of power to supply consumers overnight. It could also reduce the cost of electrolyzers, which can convert renewable electricity into hydrogen and other fuels that can be stored for months or years, and drop the cost of fuel cells that convert those fuels back into electricity when needed.

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

Not bad for a piece of technology that most of us will never see.

Science, 26 April 2023

https://science.org

Salamander Dads Are Turning Into Cannibals, Threatening Species Survival

2023-04-20

The hellbender salamander has been called a lot of things. Snot otter. Mud devil. Old lasagna sides.

And now, perhaps: baby-eating cannibal, according to new research into the parental habits of these giant amphibians.

An eight-year study of hellbenders living in the cold, rocky rivers of southwestern Virginia has found that male salamanders are increasingly consuming their own young in areas near decimated forests.

The hellbenders' alarming change in behavior may be linked to de-forestation, a new study found.

Without abutting trees, pollutants flow into the rivers, leading to changes in water chemistry that seem to be altering paternal behavior, the researchers said.

Infanticide is becoming so widespread that eastern hellbenders — the largest salamander in North America, measuring two feet long and weighing up to five pounds — may be on the cusp of eating their future generations into extinction.

"If you have rates of cannibalism this high, then that alone is enough to explain many of the population declines we've seen across the species range," said Bill Hopkins, an ecologist at Virginia Tech who led the research. The findings will appear in a forthcoming issue of The American Naturalist.

Eastern hellbenders once thrived across 15 states, from Mississippi and Missouri in the South and Midwest to New York and Pennsylvania in the Northeast. Their numbers have dwindled over the past 50 years, however, and researchers have struggled to explain why.

Habitat loss, disease, poaching and climate change all probably contribute to some extent. But according to Dr. Hopkins's research, the driving factor might be baby-eating in response to deforestation.

The practice of eating one's own offspring, known as filial cannibalism, is common among species that, like the eastern hellbender, have evolved a parenting system in which fathers provide the bulk of early care.

In the fall breeding season, female hellbenders lay their clutch of eggs and take off. Males fertilize the eggs externally and then stick around for months, helping to fend off predators and to keep the eggs healthy until they hatch.

But in the face of hardship, these dedicated dads morph into amphibious Hannibal Lecters, eating up broods with low chances of survival. This act of reproductive sacrifice helps the salamanders conserve energy in lean times and boosts their chances of surviving long enough to make more and stronger babies in the future.

Biologists who study hellbender behavior had previously noted this form of infanticide on occasion. However, Dr. Hopkins's research suggests that filial cannibalism may be on the rise, with environmental damage — spurred by human activities such as cutting down forests for cattle pastures — likely to blame.

Dr. Hopkins and his colleagues set up hundreds of underwater nest boxes in three rivers dotted across the upper Tennessee River Basin of southwestern Virginia. From 2013 to 2020, they monitored each box, tracking the fate of any egg clusters they found.

They saw that in areas with lush forest cover, dads ate their entire spawn around 14 percent of the time. But this happened more than three times as often wherever nearby trees had been cut down.

The hellbenders seem to have fallen into what Hope Klug, an evolutionary biologist from the University of Tennessee at Chattanooga, described as "an evolutionary trap."

"They're exhibiting this behavior that was once adaptive," she said, "but it's no longer adaptive due to this really rapid environmental change."

Shem Unger, a conservation geneticist at Wingate University in North Carolina, said that the findings were alarming. "We need to ensure streams are protected, so that these giants of the rivers remain for future generations," he said.

Dr. Hopkins's team also collected blood samples from the hellbenders and looked for changes in stress and reproductive hormones at sites of forest degradation that might account for the uptick in cannibalism. They came up empty-handed. Body condition, clutch size or food availability didn't seem to be implicated either.

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

Dr. Hopkins suspects that changes in water chemistry could be spurring the behavioral shift, and he now has sensors in place tracking river conditions to test that hypothesis.

Efforts are ongoing to create forested buffers along streams that reduce erosion, filter pollutants and improve overall water conditions for hellbenders. But in the meantime, Dr. Hopkins is planning to collect vulnerable eggs, raise them in his laboratory and reintroduce them as larvae — past the age when they typically fall prey to their dad's attack.

"It's a stopgap," said J.D. Kleopfer, a herpetologist with the Virginia Department of Wildlife Resources, who is helping to coordinate the effort. "We're kind of holding the line while the habitat restoration work catches up."

The New York Times, 20 April 2023

https://nytimes.com

New nanoparticle source generates high-frequency light

2023-04-27

High-frequency light is useful. The higher the frequency of light, the shorter its wavelength – and the shorter the wavelength, the smaller the objects and details the light can be used to see.

So violet light can show you smaller details than red light, for example, because it has a shorter wavelength. But to see really, really small things – down to the scale of billionths of a metre, thousands of times less than the width of a human hair – to see those things, you need extreme ultraviolet light (and a good microscope).

Extreme ultraviolet light, with wavelengths between 10 and 120 nanometres, has many applications in medical imaging, studying biological objects, and deciphering the fine details of computer chips during their manufacture. However, producing small and affordable sources of this light has been very challenging.

We have found a way to make nanoparticles of a common semiconductor material emit light with a frequency up to seven times higher than the frequency of light sent to it. We generated blue-violet light from infrared light, and it will be possible to generate extreme ultraviolet light from red light with the same principles. Our research, carried out with colleagues

Extreme ultraviolet light has many applications in medical imaging, studying biological objects, and deciphering the fine details of computer chips during their manufacture.

from the University of Brescia, the University of Arizona and Korea University, is published in Science Advances.

The power of harmonics

Our system starts out with an ordinary laser that produces long-wavelength infrared light. This is called the pump laser, and there's nothing special about it – such lasers are commercially available, and they can be compact and affordable.

But next we fire short pulses of light from this laser at a specially engineered nanoparticle of a material called aluminium gallium arsenide, and that's where things get interesting.

The nanoparticle absorbs energy from the laser pulses, and then emits its own burst of light. By carefully engineering the size and shape of the nanoparticle, we can create powerful resonances to amplify certain harmonics of the emitted light.

What does that mean, exactly? Well, we can make a useful analogy with sound.

When you pluck a string on a guitar, it vibrates with what's called its fundamental frequency – which makes the main note you hear – plus small amounts of higher frequencies called harmonics, which are multiples of the fundamental frequency. The body of the guitar is designed to produce resonances that amplify some of these harmonics and dampen others, creating the overall sound you hear.

Both light and sound share similarities in their physics – these are both propagating waves (acoustic waves in the case of sound, and electromagnetic waves in the case of light).

In our light source, the pump laser is like the main note of the string, and the nanoparticles are like the guitar body. Except what's special about the nanoparticles is that they massively amplify those higher harmonics of the pump laser, producing light with a higher frequency (up to seven times higher in our case, and a wavelength correspondingly seven times shorter).

What it's good for

This technology allows us to create new sources of light in parts of the electromagnetic spectrum such as the extreme ultraviolet, where there are no natural sources of light and where current engineered sources are too large or too expensive.

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

Conventional microscopes using visible light can only study objects down to a size of about a ten-millionth of a metre. The resolution is limited by the wavelength of light: violet light has the wavelength of about 400 nanometres (one nanometre is one billionth of a metre).

But there are plenty of applications, such as biological imaging and electronics manufacturing, where being able to see down to a billionth of a metre or so would be a huge help.

At present, to see at those scales you need "super-resolution" microscopy, which lets you see details smaller than the wavelength of the light you are using, or electron microscopes, which do not use light at all and create image using a flux of electrons. However, such methods are quite slow and expensive.

To understand the advantages of a light source like ours, consider computer chips: they are made of very tiny components with feature sizes almost as small as a billionth of a metre. During the production process, it would be useful for manufacturers to use extreme ultraviolet light to monitor the process in real time.

This would save resources and time on bad batches of chips. The scale of the industry is such that even a 1% increase in chip yields could save billions of dollars each year.

In future, nanoparticles like ours could be used to produce tiny, inexpensive sources of extreme ultraviolet light, illuminating the world of extremely small things.

The Conversation, 27 April 2023

https://theconversation.com

This pioneering nuclear-fusion lab is gearing up to break more records

2023-04-26

Last month, the US National Ignition Facility (NIF) fired its lasers up to full power for the first time since December, when it achieved its decades-long goal of 'ignition' by producing more energy during a nuclear reaction than it consumed. The latest run didn't come close to matching up: NIF achieved only 4% of the output it did late last year. But scientists didn't expect it to.

Following the US National Ignition Facility's breakthrough last year, Nature looks at what's next.

Building on NIF's success, they are now flexing the programme's experimental muscles, trying to better understand the nuclear-fusion facility's capabilities. Here, Nature looks at what's to come for NIF, and whether it will propel global efforts to create a vast supply of clean energy for the planet.

What was the goal of the latest experiment?

NIF, based at Lawrence Livermore National Laboratory (LLNL) in California, is a stadium-sized facility that fires 192 lasers at a tiny gold cylinder containing a diamond capsule. Inside the capsule sits a frozen pellet of the hydrogen isotopes deuterium and tritium. The lasers trigger an implosion, creating extreme heat and pressure that drive the hydrogen isotopes to fuse into helium, releasing additional energy.

One of the main challenges in getting this scheme to work is fabricating the diamond capsule. Even the smallest defects — bacterium-sized pockmarks, metal contamination or variations in shape and thickness — affect the implosion, and thus the pressure and heat that drive the fusion reactions.

Record-breaking experiments in 2021 and 2022 used the best capsules available, but in March, while waiting for a new batch, NIF scientists ran an experiment with a capsule that was thicker on one side than the other. Modelling suggested that they could offset this imperfection by adjusting the beams coming from the lasers, to produce a more uniform implosion. This was a test of their theoretical predictions, says Richard Town, a physicist who heads the lab's inertial-confinement fusion science programme at the LLNL.

The results fell short of their predictions, and researchers are now working to understand why. But if this line of investigation pays off, Town says, "it opens up more capsules for us to use and will improve our understanding of implosion".

What comes next at NIF?

Scientists succeeded in December by boosting the lasers' energy and increasing the capsule thickness, which helps to prolong the fusion reactions. Experiments later this year will follow a similar strategy, says Annie Kritcher, a physicist who is leading the design of the campaign.

In the long term, the goal is to increase the amount of energy generated by fusion reactions from the 3.15 megajoules created last year to hundreds of megajoules. Town sees a viable path to increasing NIF's energy yields

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

to tens of megajoules by, among other things, further boosting the lasers' energy going into the target. But he warns that NIF might soon need to make substantial safety upgrades: the facility is rated only for fusion yields of up to 45 megajoules. Before conducting any experiments that could approach that limit, the lab will need to, in strategic locations, reinforce the nearly 2-metre-thick concrete walls that contain the reaction.

How does this help the push to create fusion energy for the planet?

NIF was never designed to be a power plant. Its main goal was to help scientists verify that weapons in the US nuclear stockpile are reliable and safe by recreating and studying the reactions at their core. But hitting ignition in December "was a gateway event that opens the door for an energy programme", says Stephen Dean, president of Fusion Power Associates, an advocacy group in Gaithersburg, Maryland.

The record-breaking experiment produced around 50% more energy than was delivered to the gold cylinder — and importantly, nearly 13 times the energy concentrated on the inner fuel pellet. For Max Karasik, a physicist at the Naval Research Laboratory in Washington DC, this highlights a potential path forward that he and others are pursuing: jettison the gold cylinder and focus the lasers directly on the fuel pellet, an experimental design known as direct drive.

In this configuration, "there is much more energy available for compressing the fuel pellet", Karasik says.

But the challenges ahead for fusion energy are daunting. NIF's lasers consumed 322 megajoules of energy in the landmark experiment in December. To deliver power to the public, Dean says, a laser-fusion plant would need to generate 100 times more energy than was input, and its lasers would need to fire around 10 times per second. This means designing a system that can accurately focus and fire the lasers on hundreds of thousands of targets each day.

With its current design, NIF will remain a place where scientists can learn from high-yield laser-fusion experiments, lab officials say. But in the meantime, private companies are increasingly stepping up with alternative solutions.

Last year, US President Joe Biden's administration laid out its vision for a public–private partnership in fusion energy at a White House summit. The private sector will take the lead in pioneering new fusion technologies, while the US Department of Energy (DOE), of which NIF is a part, will

advance knowledge in broader areas such as materials science, advanced manufacturing and modelling that will be crucial to commercialization.

Over the next 18 months, the DOE is looking to dole out US$50 million in grants to private fusion companies in a milestone-based programme modelled on NASA's partnership with space-transport firms such as SpaceX. Laser-fusion companies will compete with firms pursuing other fusion designs, however. One of the most popular is the tokamak, a device that creates a magnetic field to contain the burning plasma generated by a fusion reaction in a doughnut-shaped 'torus'. This is the approach being used by the world's largest fusion experiment, ITER, in Saint-Paul-lès-Durance, France.

What are the odds of success?

The old joke about fusion energy is that it's 50 years away, and always will be. Many scientists now say the front end of that equation is closer to 20–30 years, but it's really just a matter of funding, says Pravesh Patel, a former scientist at Lawrence Livermore National Lab who currently serves as scientific director at Focused Energy in Austin, Texas, a private laser-fusion firm.

"As a scientist, I think fusion energy is inevitable," he says. "The question is just how quickly we want it to work, and that depends on resources."

Nature, 26 April 2023

https://nature.com

Lab-made lungs fast-track drug testing, can replace animal test subjects

2023-04-26

Researchers have built a lung in a lab that more accurately emulates the human lung than traditional models, opening the door to the fast-tracking of the discovery and development of drugs and a reduction in our reliance on animals for testing.

Lung diseases are a leading cause of death globally. According to the World Health Organization (WHO), chronic obstructive pulmonary disease, COPD, will become the third leading cause of death by 2030 due to worsening air quality and the after-effects of COVID-19.

COPD is an incurable condition that obstructs the small airways in the lungs, making breathing difficult, with smoking and air pollution the most

"We are literally creating a mimic organ that is very much like actual human lungs."

CHEMWATCH
Bulletin Board
Gossip
MAY. 05, 2023

common causes. Current methods of treatment are unable to reverse the damage caused to lung tissue. While newer treatments, such as stem cell-based medicines, have shown an ability to repair or prevent lung deterioration, there has been a distinct lack of new therapies approved for treating lung disease.

Traditionally, developing and testing new drugs for COPD requires animal models. The problem with using animals for testing is that some aspects of their anatomy and physiology differ from that of humans, and many animal models don't allow for the testing of aerosol drugs.

Recently, there have been advances made concerning developing alternatives to animal models. Organs-on-a-chip, organoids – 3D structures grown from human cells that mimic real organs – and 3D-printed organs are great examples. But these have downsides, often related to their small size, limited number of cells, and lack of similarity with the complex structures and processes seen in the human lung. But now, a team led by researchers from the University of Sydney has built lungs that more accurately emulate the human lung.

"With a traditional cell culture, you put cells into a Petri dish and culture them in static conditions, which is far from what happens in a human body," said Thanh Huyen Phan, lead author of the study. "What we are doing is creating environmental conditions similar to those which exist in the human body."

Taking cells directly from a patient, the researchers arranged them in layers, just as they appear in the body.

"We take cells directly from patients and then build them in layers as they exist inside the body," said Wojciech Chrzanowski, the study's corresponding author. "So, first you have the epithelial cells, then you have the fibroblasts – we are literally creating a mimic organ that is very much like actual human lungs."

The lung models are maintained under the same environmental conditions as real lungs, with air on one side and a liquid interface combined with microcirculation to mimic the body's circulatory system on the other. The researchers created two lung models for different uses.

"We decided to build two different lung models, one of which mimics phase one clinical trials; a healthy lung to study safety of new drugs," Chrzanowski said. "The other one mimics phase two trials; a diseased lung

that, in our case, mirrors chronic obstructive pulmonary disease, enabling us to study the therapeutic effectiveness or superiority of the drugs."

But the lung models can be used for more than just drug testing.

"These mini-lung organoid models can also be used to test toxicity," Chrzanowski said. "For example, of silica dust or air pollutants, such as particulates generated during bushfires."

And, what's more, they can be individualized.

"Because we can take cells directly from individual patients, we can build a patient's own model to test the effectiveness of drugs on them," said Chrzanowski.

The researchers say that in addition to providing an alternative to animal testing, the advantages of their lab-made lungs are their reproducibility, reliability, and their ability to enable research cost-effectively on a large scale.

"They accelerate the process of discovery, they shorten the process of getting to clinics, but also substantially increase our confidence in the molecules we create before we go to clinical trials," Chrzanowski said. "The normal timeline for the clinical translation of a drug is about 10 to 15 years, but when you use organoid models, you can shrink that time substantially."

New Atlas, 26 April 2023

https://newatlas.com

CHEMWATCH
Bulletin Board

Depressed? Anxious? Air pollution may be a factor

2023-04-23

In the 1990s, residents of Mexico City noticed their dogs acting strangely — some didn't recognize their owners, and the animals' sleep patterns had changed.

At the time, the sprawling, mountain-ringed city of more than 15 million people was known as the most polluted in the world, with a thick, constant haze of fossil fuel pollution trapped by thermal inversions.

In 2002, toxicologist and neuropathologist Lilian Calderón-Garcidueñas, who is affiliated with both Universidad del Valle de México in Mexico City and the University of Montana, examined brain tissue from 40 dogs that had lived in the city and 40 others from a nearby rural area with cleaner air. She discovered the brains of the city dogs showed signs of neurodegeneration while the rural dogs had far healthier brains.

Calderón-Garcidueñas went on to study the brains of 203 human residents of Mexico City, only one of which did not show signs of neurodegeneration. That led to the conclusion that chronic exposure to air pollution can negatively affect people's olfactory systems at a young age and may make them more susceptible to neurodegenerative diseases such as Alzheimer's and Parkinson's.

The pollutant that plays the "big role" is particulate matter, said Calderón-Garcidueñas. "Not the big ones, but the tiny ones that can cross barriers. We can detect nanoparticles inside neurons, inside glial cells, inside epithelial cells. We also see things that shouldn't be there at all — titanium, iron, and copper."

The work the Mexican scientist is doing is feeding a burgeoning body of evidence that shows breathing polluted air not only causes heart and lung damage but also neurodegeneration and mental health problems.

It's well established that air pollution takes a serious toll on the human body, affecting almost every organ. Asthma, cardiovascular disease, cancer, premature death, and stroke are among a long list of problems that can be caused by exposure to air pollution, which, according to the World Health Organization, sits atop the list of health threats globally, causing 7 million deaths a year. Children and infants are especially susceptible.

Sussing out the impact of air pollution on the brain has been more difficult than for other organs because of its inaccessibility, so it has not been researched as thoroughly, according to researchers. Whether air pollution

A growing body of research is finding links between air quality and mental health, as therapists report seeing patients with symptoms linked to pollution.

may cause or contribute to Alzheimer's or Parkinson's is not settled science. But Calderón-Garcidueñas' work is at the leading edge of showing that air pollution goes directly into the brain through the air we breathe, and has serious impacts.

Some psychotherapists report seeing patients with symptoms stemming from air pollution. Not only does the pollution appear to cause symptoms or make them worse; it also takes away forms of relief.

"If we exercise and spend time in nature we become extra resilient," said Kristen Greenwald, an environmental social worker and adjunct professor at the University of Denver. "A lot of folks do that outside. That's their coping mechanism; it's soothing to the nervous system."

On polluted days a lot of her clients "can't go outside without feeling they are making themselves more sick or distressed."

Megan Herting, who researches air pollution's impact on the brain at the University of Southern California, said environmental factors should be incorporated in doctors' assessments these days, especially in places like Southern California and Colorado's Front Range, where high levels of air pollution are a chronic problem.

"When I go into a medical clinic, they rarely ask me where I live and what is my home environment like," she said. "Where are we living, what we are exposed to, is important in thinking about prevention and treatment."

In the last two decades, with new technologies, research on air pollution and its impact on the human nervous system has grown by leaps and bounds.

Research shows tiny particles bypass the body's filtering systems as they are breathed in through the nose and mouth and travel directly into the brain. Fine and ultrafine particles, which come from diesel exhaust, soot, dust, and wildfire smoke, among other sources, often contain metals that hitchhike a ride, worsening their impact.

A changing climate is likely to exacerbate the effects of air pollution on the brain and mental health. Warmer temperatures react with tailpipe emissions from cars to create more ozone than is generated when it's cooler. And more and larger forest fires are expected to mean more days of smoky skies.

Ozone has been linked to neurodegeneration, decline in cerebral plasticity, the death of neurons, and learning and memory impairment.

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

Ozone levels are extremely high in Los Angeles and the mountain valleys of the West, including the Front Range of Colorado, Phoenix, and Salt Lake City.

Air pollution also causes damage from chronic inflammation. As air pollution particles enter the brain, they are mistaken for germs and attacked by microglia, a component of the brain's immune system, and they stay activated.

"Your body doesn't like to be exposed to air pollution and it produces an inflammatory response," said Patrick Ryan, a researcher at Cincinnati Children's Hospital, in an email. "Your brain doesn't like it either. There's more than 10 years of toxicological science and epidemiologic studies that show air pollution causes neuro-inflammation."

Much of the current research focuses on how pollution causes mental health problems.

Damage to the brain is especially pernicious because it is the master control panel for the body, and pollution damage can cause a range of neuropsychiatric disorders. A primary focus of research these days is how pollution-caused damage affects areas of the brain that regulate emotions — such as the amygdala, prefrontal cortex, and hippocampus. The amygdala, for example, governs the processing of fearful experiences, and its impairment can cause anxiety and depression. In one recent review, 95% of studies looking at both physical and functional changes to areas of the brain that regulate emotion showed an impact from air pollution.

A very large study published in February in JAMA Psychiatry, by researchers from the universities of Oxford and Peking and Imperial College London, tracked the incidence of anxiety and depression in nearly 400,000 adults in the United Kingdom over a median length of 11 years and found that long-term exposure even to low levels of a combination of air pollutants — particulate matter, nitrogen dioxide, and nitric oxide — increased the occurrence of depression and anxiety.

Another recent study, by Erika Manczak at the University of Denver, found adolescents exposed to ozone predicted "for steeper increases in depressive symptoms across adolescent development."

But the epidemiological research has shortcomings because of confounding factors that are difficult to account for. Some people may be genetically predisposed to susceptibility and others not. Some may

experience chronic stress or be very young or very old, which can increase their susceptibility. People who reside near a lot of green space, which reduces anxiety, may be less susceptible.

"Folks living in areas where there is greater exposure to pollutants tend to be areas under-resourced in many ways and grappling with a lot of systemic problems. There are bigger reports of stress and depression and anxiety," said Manczak. "Given that those areas have been marginalized for a lot of reasons, it's a little hard to say this is due to air pollution exposure."

The best way to tell for sure would be to conduct clinical trials, but that comes with ethical problems. "We can't randomly expose kids to air pollution," Ryan said.

Kansas Reflector, 23 April 2023

https://kansasreflector.com

Vitamin D: Immunotherapy Booster Against Skin Cancer?

2023-04-24

New research indicates that for patients with advanced skin cancer, it may be important to maintain normal vitamin D levels when receiving immunotherapy medications called immune checkpoint inhibitors. The findings are published today (April 24) by Wiley online in CANCER, a peer-reviewed journal of the American Cancer Society.

Vitamin D has many effects on the body, including regulation of the immune system. To see whether levels of vitamin D might impact the effectiveness of immune checkpoint inhibitors, investigators analyzed the blood of 200 patients with advanced melanoma both before and every 12 weeks during immunotherapy treatment.

A favorable response rate to immune checkpoint inhibitors was observed in 56.0% of patients in the group with normal baseline vitamin D levels or normal levels obtained with vitamin D supplementation, compared with 36.2% in the group with low vitamin D levels without supplementation. Progression-free survival—the time from treatment initiation until cancer progression—in these groups was 11.25 and 5.75 months, respectively.

"Of course, vitamin D is not itself an anti-cancer drug, but its normal serum level is needed for the proper functioning of the immune system, including the response that anti-cancer drugs like immune checkpoint inhibitors affect," said lead author Łukasz Galus, MD, of Poznan University

Research suggests that maintaining normal vitamin D levels may benefit cancer patients.

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

of Medical Sciences, in Poland. "In our opinion, after appropriately randomized confirmation of our results, the assessment of vitamin D levels and its supplementation could be considered in the management of melanoma."

The main sources of vitamin D are:

Sunlight: The body can produce vitamin D when the skin is exposed to ultraviolet B (UVB) rays from sunlight. The amount of vitamin D produced depends on factors such as skin type, time of day, season, and latitude.

Food: Some foods contain small amounts of vitamin D, including fatty fish (such as salmon, mackerel, and sardines), fish liver oils, egg yolks, and fortified foods like milk, orange juice, and certain cereals.

Supplements: Vitamin D supplements are available in two forms – D2 (ergocalciferol) and D3 (cholecalciferol). Both forms can help maintain adequate vitamin D levels, especially for people with limited sun exposure or difficulty obtaining enough vitamin D from food. It is essential to consult a healthcare professional before starting any supplementation to determine the appropriate dosage.

Sci Tech Daily, 24 April 2023

https://scitechdaily.com

'Game changer' method lets scientists peer into—and fly through—mouse bodies

2023-04-25

A research team has turned the bodies of dead mice into vivid 3D maps of anatomy, with tissues, nerves, and vessels highlighted in color. The technique, which renders the corpses transparent and then exposes them to fluorescent antibodies that label distinct cell types, could help everything from drug development to understanding the spread of cancer, its creators and other scientists say.

The developers, at the Helmholtz Munich research institute, call their technique wildDISCO—wild because it can work on any "wild type," or normal, mice, and DISCO for 3D imaging of solvent-cleared organs. Building on their previous success at making mouse bodies transparent, the new technique removes cholesterol from the bodies so that a vast array of existing antibodies can penetrate deep into the animals. "wildDISCO is a game changer—it allows us to see the hidden highways and byways in the body," says Muzlifah Haniffa, a dermatologist and

Latest version of imaging technique enables use of thousands of antibodies that can map specific cell types

immunologist at the Wellcome Sanger Institute and Newcastle University's Biosciences Institute who was not involved in the research.

The method should let scientists map a mouse at the cellular level and explore previously hidden links between tissues, like neural connections between organs, says neuroscientist Ali Ertürk, director of Helmholtz Munich, who led the work, posted recently as a preprint. His group in Germany has already posted eye-catching videos of "flying" through the 3D anatomy of a mouse with different tissues labeled.

The method is a variation of work his team started more than a decade ago, when various scientists were developing novel ways, such as one called CLARITY, to chemically treat tissue samples and isolated organs so they became transparent and the cells inside could be seen. Ertürk and colleagues developed a similar method that made entire mouse bodies transparent. Seeking a way to pick out different cell types in the see-through bodies, they turned to nanobodies, synthetic antibodies that are much smaller than standard ones and can slip more easily into the tissue. But only a handful of nanobodies have been designed for specific cell types, limiting efforts to map the mice bodies.

So the group went looking for a way to expand its method to the thousands of standard, bigger antibodies already available commercially. Ertürk's team found that treating mouse bodies for 2 weeks with a chemical called beta-cyclodextrin dissolves cholesterol in the cell membrane, creating spongelike holes in the whole organism without damaging other parts of the tissues. This allows standard immunoglobulin G antibodies, targeting various cell types and easily ordered from many companies, to penetrate deeply into all the mouse tissues. So far, Ertürk says his team has shown that more than 30 antibodies work with wildDISCO, including markers of the nervous system, vasculature, immune system, and proliferating cells—and the list is growing, he adds.

"This is exciting, and the immunolabeling data are quite impressive," says Alain Chédotal, a neuroscientist at the Vision Institute in Paris who was not involved in the study. So are the fly-through visualizations of the data, he says. "This study also nicely shows that virtual reality is a great way to navigate through large 3D image data sets."

Chédotal stresses that more work is needed for wildDISCO to reach its full potential. The preprint only shows it working with two antibodies simultaneously, allowing just two cell types at a time to be labeled. "We are working on solving this problem," says Jie Luo, who with his Helmholtz

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

Munich colleague Hongcheng Mai shares first authorship on the study. "We are working on using three and four antibodies at the same time."

Still, Chédotal believes the team's visualizations show previously unknown details of the enteric nervous system, a collection of nerve cells driving gastrointestinal functions, and some of the nodes, vessels, and organs in the lymphatic system. Next, Ertürk predicts, his team will make a complete map of the lymphatic system, which could sharpen the picture of how cancer metastasizes and how best to treat it.

Science, 25 April 2023

https://science.org

Are you putting PFAS on your eyeballs?

2023-04-26

Eighteen kinds of soft contact lenses have detectable levels of organic fluorine, an indicator of the group of chemicals known as PFAS, according to a new report from Mamavation.

New study finds evidence of the "forever chemicals" in all 18 brands of contact lenses tested.

Partnering with EHN.org, the environmental wellness blog and community had the contact lenses tested by a U.S.-Environmental-Protection-Agency-certified lab and found levels of organic fluorine ranging from 105 parts per million, or ppm, to 20,700 ppm. Eight out of the 18 lenses tested had more than 4,000 ppm of organic fluorine.

Fluorine is a strong indicator of "forever chemicals"— which have been linked to everything from cancer to birth defects to lower vaccine effectiveness.

EHN.org partially funded the testing and Pete Myers, chief scientist of Environmental Health Sciences, which publishes Environmental Health News, reviewed the findings. The report builds EHN.org and Mamavation's growing library of consumer products tested for evidence of PFAS, including products such as pasta and tomato sauces, sports bras, tampons and dental floss.

While many are aware of PFAS pollution in water, the testing finds that we're also exposed by the things we wear or eat. You can explore the reporting, "PFAS on our shelves and in our bodies," here.

While the health impacts of PFAS exposure via the eyes are still somewhat unclear, Linda Birnbaum, scientist emeritus and former director of the National Institute of Environmental Health Sciences and National

Toxicology Program, told Mamavation "Your eyes are one of the most sensitive parts of your body. Therefore, it's concerning to see the presence of organic fluorine, which is likely a type of PFAS, found in all soft contact lens products tested. What about the idea of doing no harm? Do we have proof these products are safe? A lack of safety studies does not qualify as 'safety,' which is what is happening here."

Why is fluorine in contact lenses?

Given the high levels found during testing, it's likely that fluoropolymers (which are usually PFAS chemicals) are intentionally added to contact lenses in order to soften the lenses and allow oxygen to pass through.

In a 2020 study, researchers warned of the human health risks of fluoropolymers.

"Given fluoropolymers' extreme persistence; emissions associated with their production, use, and disposal; and a high likelihood for human exposure to PFAS, their production and uses should be curtailed except in cases of essential uses," they wrote.

Terrence Collins, Teresa Heinz Professor of Green Chemistry & Director of the Institute for Green Sciences at Carnegie Mellon University, told Mamavation that fluoropolymers improve the "technical performance of contact lenses at attractive price performances," but this ignores health and environmental impacts.

"If you use fluoropolymer-containing contact lenses, you are likely to become permanently contaminated. No one today can tell you that fluoropolymer exposures are safe, because no jurisdiction has been demanding the development and scrutiny of appropriate safety testing."

What brands had contamination?

All of the contact lenses — which were donated to Mamavation by someone working at an ophthalmologist's office in the fall of 2022 — had organic fluorine.

The testing included different products from three popular brands: Acuvue, Alcon and Coopervision. The three lenses with the highest amounts of organic fluorine were Alcon Air OPTIX (No Hydraglide) Soft Contact Lenses for Astigmatism (20,000 ppm), Alcon AIR OPTIX COLORS

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

Contact Lenses with Smartshield Technology (20,700 ppm) and Alcon Total30 Contact Lenses for Daily Wear (20,400 ppm).

Environmental Health News, 26 April 2023

https://ehn.org

Sleeping elephant seals fall through ocean's depths, and some even nap on the sea floor

2023-04-21

The ocean is full of weird and wonderful things, and as a general rule, the deeper you go, the weirder it gets.

Thanks to research published in Science on Friday, we can add freefalling elephant seals into the mix.

Researchers fitted elephant seals (Mirounga angustirostris) in Monterey Bay, California with electroencephalogram (EEG) sensors — the same type used to measure human brain activity.

They also added a few other measuring devices like accelerometers, heart monitors, and time and depth recorders.

Some elephant seals fell to depths of over 370m while asleep.

Then they let the seals go on their way, and recovered the recording equipment when the seals returned to land.

The data showed that while spending long periods at sea, the elephant seals would make their way down to deep, dark water, and nod off. When they did, they'd enter a kind of freefall toward the ocean floor.

In the slow-wave sleep phase, they'd fall with a rigid body posture, straight down, but after entering REM (rapid eye-movement) sleep, they experienced body paralysis and spiralled toward the bottom like a falling leaf.

The seals would sleep less than 20 minutes at a time, sinking to depths of up to 377 metres.

Sometimes they'd even hit the sea floor and go on sleeping, according to study lead author, PhD candidate Jessica Kendall-Bar from the University of California Santa Cruz.

"Seals approaching the continental shelf — about 200 metres deep — would sometimes wake up upon coming into contact with the bottom," Ms Kendall-Bar said.

"But more often they continued to sleep as they settled on the bottom on their bellies or backs."

Some marine animals like dolphins are capable of "unihemispheric sleep", where they keep one side of the brain awake and one eye open.

But elephant seals are more like us, in that they go into total torpor.

Scientists suspected elephant seals must sleep underwater because the animals spend so much time at sea.

The northern elephant seals in this study go on foraging trips for seven months or more, covering more than 10,000 kilometres. They're capable of diving to around 2,000 metres.

Earlier studies had fitted elephant seals with tracking instruments that showed they were making repetitive, slow dives.

But measuring the animals' brain activity has added another layer to the story, according to study co-author Terrie Williams of the University of California Santa Cruz.

"Given the duration of time the seals are at sea they had to sleep sometime," Professor Williams said.

"By measuring brain activity, we now know they're sleeping. And not any old sleep, but deep, paralytic sleep — that is when a human would start snoring."

Behaviour likely to help avoid sharks, killer whales

The study found that, on average, the seals managed around two hours sleep a day over a seven-month period.

That means they rival the African elephant for the record of lowest amount of sleep for a mammal. African elephants sleep around two hours a day all year round.

Though some seals were found to be sleeping on the sea floor in quite shallow water, the shallowest instance of the spiral-shaped falling during REM sleep was measured at 82m. The deepest was 377m.

Their predators such as killer whales and great white sharks tend to hunt in shallower water, explained co-author Daniel Costa of the University of California Santa Cruz.

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

"Where is the one place that all marine mammals have to go? The surface to breathe. So if you are a predator looking for prey, [hunting at the surface is] going to be much more effective than trying to find prey in the water column," Professor Costa said.

"So elephant seals spend as little time at the surface as possible."

Logically it is safest to nap, forage, even feed your babies, away from your predators.

Elephant seals come ashore for brief periods to mate, moult and give birth.

They also spend a lot of this shore leave catching up on lost sleep.

The researchers attached their custom-made monitoring equipment to seals on beaches in California.

Elephant seals have high site fidelity, meaning they'll come back to the same beach over and over, Ms Kendall-Bar said.

"Even after trips to sea that last multiple days, they come right back to the beach, where a team of specialists remove the equipment."

Robert Harcourt, a marine ecologist at Macquarie University, said the data could also be used to figure out what else was going on deep in the ocean.

"When they go to sea they've either had a baby or the males have been breeding. So they're skinny," said Professor Harcourt, who was not involved with the study.

"As they hit patches of food, they get fatter. And what that means is that they switch over from being negatively buoyant to positively buoyant and so they drift slower down."

In other words, by recording the rate at which the seals sink, or don't, and where, we can tell how much weight they've gained.

"Which is phenomenal because ... we can use that to work out where all the food is in the Southern Ocean and north-eastern Pacific.

"It's a really amazing study. They've got an amazing dataset."

ABC News, 21 April 2023

https://abc.net.au

Mystery solved as scientists discover how quasars are made

2023-04-26

Where do quasars – the brightest, most powerful objects in the universe – come from? British researchers have discovered that they are ignited by the collision of galaxies.

Quasars, or "quasi-stellar astronomical objects", were first discovered in 1962. Since then, astrophysicists have wondered what could power these objects that somehow manage to pack the brightness of a trillion suns into a volume the size of our solar system.

Researchers from the Universities of Sheffield and Hertfordshire used deep imaging observations from the Isaac Newton Telescope in La Palma on the Canary Islands to find the tell-tale signs of galactic mergers around quasars.

All galaxies have gas. And lots of it. A large portion of this gas lies out of the reach of the supermassive black holes that dwell in the centres of most galaxies.

But galactic collisions drive this gas towards the supermassive black holes where the gases eventually fall victim to the immense gravitational pull of the behemoth at the centre of the galaxy. Just before being consumed, the gas in the merging galaxies release extraordinary amounts of radiation. And voila, a quasar is born.

Distorted structures in the outer regions of galaxies that contain quasars suggest such a genesis.

The astrophysicists compared 48 galaxies hosting quasars with more than 100 non-quasar galaxies. Their results show that galaxies with quasars are about three times as likely to be interacting or colliding with other galaxies.

"Quasars are one of the most extreme phenomena in the universe, and what we see is likely to represent the future of our own Milky Way galaxy when it collides with the Andromeda galaxy in about five billion years," says the University of Sheffield's Professor Clive Tadhunter. "It's exciting to observe these events and finally understand why they occur – but thankfully Earth won't be anywhere near one of these apocalyptic episodes for quite some time."

Where do quasars – the brightest, most powerful objects in the universe – come from? British researchers have discovered that they are ignited by the collision of galaxies.

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

"It's an area that scientists around the world are keen to learn more about," adds Dr Jonny Pierce from the University of Hertfordshire. "One of the main scientific motivations for NASA's James Webb Space Telescope was to study the earliest galaxies in the universe, and Webb is capable of detecting light from even the most distant quasars, emitted nearly 13 billion years ago. Quasars play a key role in our understanding of the history of the universe, and possibly also the future of the Milky Way."

Cosmos, 26 April 2023

https://cosmosmagazine.com

Can machines be self-aware? New research explains how this could happen

2023-04-27

To build a machine, one must know what its parts are and how they fit together. To understand the machine, one needs to know what each part does and how it contributes to its function. In other words, one should be able to explain the "mechanics" of how it works.

According to a philosophical approach called mechanism, humans are arguably a type of machine – and our ability to think, speak and understand the world is the result of a mechanical process we don't understand.

To understand ourselves better, we can try to build machines that mimic our abilities. In doing so, we would have a mechanistic understanding of those machines. And the more of our behaviour the machine exhibits, the closer we might be to having a mechanistic explanation of our own minds.

This is what makes AI interesting from a philosophical point of view. Advanced models such as GPT4 and Midjourney can now mimic human conversation, pass professional exams and generate beautiful pictures with only a few words.

Yet, for all the progress, questions remain unanswered. How can we make something self-aware, or aware that others are aware? What is identity? What is meaning?

Although there are many competing philosophical descriptions of these things, they have all resisted mechanistic explanation.

In a sequence of papers accepted for the 16th Annual Conference in Artificial General Intelligence in Stockholm, I pose a mechanistic

New research papers explain how we may build a machine that's aware of itself, of others, of itself as perceived by others, and so on.

explanation for these phenomena. They explain how we may build a machine that's aware of itself, of others, of itself as perceived by others, and so on.

Intelligence and intent

A lot of what we call intelligence boils down to making predictions about the world with incomplete information. The less information a machine needs to make accurate predictions, the more "intelligent" it is.

For any given task, there's a limit to how much intelligence is actually useful. For example, most adults are smart enough to learn to drive a car, but more intelligence probably won't make them a better driver.

My papers describe the upper limit of intelligence for a given task, and what is required to build a machine that attains it.

I named the idea Bennett's Razor, which in non-technical terms is that "explanations should be no more specific than necessary". This is distinct from the popular interpretation of Ockham's Razor (and mathematical descriptions thereof), which is a preference for simpler explanations.

The difference is subtle, but significant. In an experiment comparing how much data AI systems need to learn simple maths, the AI that preferred less specific explanations outperformed one preferring simpler explanations by as much as 500%.

Exploring the implications of this discovery led me to a mechanistic explanation of meaning – something called "Gricean pragmatics". This is a concept in philosophy of language that looks at how meaning is related to intent.

To survive, an animal needs to predict how its environment, including other animals, will act and react. You wouldn't hesitate to leave a car unattended near a dog, but the same can't be said of your rump steak lunch.

Being intelligent in a community means being able to infer the intent of others, which stems from their feelings and preferences. If a machine was to attain the upper limit of intelligence for a task that depends on interactions with a human, then it would also have to correctly infer intent.

And if a machine can ascribe intent to the events and experiences befalling it, this raises the question of identity and what it means to be aware of oneself and others.

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

Causality and identity

I see John wearing a raincoat when it rains. If I force John to wear a raincoat on a sunny day, will that bring rain?

Of course not! To a human, this is obvious. But the subtleties of cause and effect are more difficult to teach a machine (interested readers can check out The Book of Why by Judea Pearl and Dana Mackenzie).

To reason about these things, a machine needs to learn that "I caused it to happen" is different from "I saw it happen". Typically, we'd program this understanding into it.

However, my work explains how we can build a machine that performs at the upper limit of intelligence for a task. Such a machine must, by definition, correctly identify cause and effect – and therefore also infer causal relations. My papers explore exactly how.

The implications of this are profound. If a machine learns "I caused it to happen", then it must construct concepts of "I" (an identity for itself) and "it".

The abilities to infer intent, to learn cause and effect, and to construct abstract identities are all linked. A machine that attains the upper limit of intelligence for a task must exhibit all these abilities.

This machine does not just construct an identity for itself, but for every aspect of every object that helps or hinders its ability to complete the task. It can then use its own preferences as a baseline to predict what others may do. This is similar to how humans tend to ascribe intent to non-human animals.

So what does it mean for AI?

Of course, the human mind is far more than the simple program used to conduct experiments in my research. My work provides a mathematical description of a possible causal pathway to creating a machine that is arguably self-aware. However, the specifics of engineering such a thing are far from solved.

For example, human-like intent would require human-like experiences and feelings, which is a difficult thing to engineer. Furthermore, we can't easily test for the full richness of human consciousness. Consciousness is a broad and ambiguous concept that encompasses – but should be distinguished from – the more narrow claims above.

I have provided a mechanistic explanation of aspects of consciousness – but this alone does not capture the full richness of consciousness as humans experience it. This is only the beginning, and future research will need to expand on these arguments.

The Conversation, 27 April 2023

https://theconversation.com

The gene-therapy revolution risks stalling if we don't talk about drug pricing

2023-04-25

"We wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.)," wrote James Watson and Francis Crick in this journal in 1953 (J. D. Watson and F. H. C. Crick Nature 171, 737–738; 1953). "This structure has novel features which are of considerable biological interest."

In the 70 years since those famous words were published, researchers have poured huge effort into unravelling those features and harnessing them for medicine. The result is a flourishing understanding of the genetic causes of diseases — and a host of therapies designed to treat them.

Seventy years from now, the world might look back on 2023 as a landmark, as well. This year could see the first authorization of a therapy based on CRISPR–Cas9 gene editing, that involves tweaking the DNA in the body's non-reproductive (somatic) cells. Gene editing allows scientists — and could soon permit clinicians — to make changes to targeted regions in the genome, potentially 'correcting' genes that cause disease. Regulators in the United States, the European Union and the United Kingdom are evaluating a therapy that uses this approach to treat sickle-cell disease, and a decision could be made in the next few months.

But even as such advances accrue, researchers are worrying about the future role of gene editing — as well as other, more established forms of gene therapy — in treating disease. Gene therapies currently carry eye-watering price tags, putting them out of the reach of many who need them. High prices could diminish the willingness of government funders to pay for gene-therapy research. And that, in turn, would make it harder for research institutions to continue to attract top talent to the field. Researchers, especially health economists, must work urgently with industry and governments to find a more affordable funding model.

Million-dollar treatments

Regulation and new intellectual property laws are needed to reduce the cost of gene-editing treatments and fulfil their promise to improve human health.

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

CRISPR–Cas9's speedy path to the clinic was paved by years of steady advances in forms of gene therapy that use a virus to shuttle genes into cells. Over the past decade, regulators have approved several such gene therapies, for example CAR-T-cell therapies, which engineer immune cells to treat cancer. Hundreds more are in clinical trials.

These therapies typically cost something like US$1 million for a single treatment, and more once the costs of administering them, such as hospital stays and procedures required to isolate and manipulate cells, are factored in. Last year, the US Food and Drug Administration approved the first gene therapy to treat haemophilia B, a genetic disease that impairs blood clotting. The price is $3.5 million per treatment, making the therapy, called Hemgenix, the most expensive drug in the world.

Gene therapies are more costly to develop and produce than are more well-established treatments based on small-molecule drugs. But gene therapies can also carry the hope of a cure, freeing recipients from both long-term reliance on expensive medicines and the risk of hospitalizations. Some have argued that this justifies the high cost: if a therapy can save millions in downstream treatments, the initial outlay would still save money overall. Over time, after all, the costs of more-conventional treatments add up: one study, for example, found that in the United States, the cost of treating a person with sickle-cell anaemia until the age of 64 is $1.7 million (K. M. Johnson et al. Blood Adv. 7, 365–374; 2023).

Even in wealthy countries, health-care systems are ill-equipped to shoulder the high initial costs associated with gene therapies. In 2021, therapeutics developer Bluebird Bio in Somerville, Massachusetts, withdrew plans to market a gene therapy for β-thalassaemia — another blood disorder — in Europe, after failing to reach an agreement with European authorities over the price. It said it would focus its sales efforts on the United States, where there has been comparatively little regulation of drug costs.

But even in the United States, costs matter. US health insurance is often subsidized by employers, and some are already saying that they will probably restrict their coverage of gene therapies in the next year, says Steven Pearson, president of the Institute for Clinical and Economic Review, a health-economics think tank in Boston, Massachusetts.

Low- and middle-income countries, meanwhile, are left entirely in the lurch. This is especially painful given that some of the diseases under consideration, such as β-thalassaemia and sickle-cell disease, are more common in poorer parts of the world than in wealthy nations. In some sub-Saharan regions, for example, it is estimated that about 2% of children

are born with sickle-cell disease. This is likely to be an underestimate, given how little screening is taking place.

Improving access

It is too soon to know how much the CRISPR–Cas9 treatment for sickle-cell disease would cost; neither of its developers, Vertex Pharmaceuticals in Boston, Massachusetts, or CRISPR Therapeutics in Cambridge, Massachusetts, have disclosed what they will charge. But researchers are bracing themselves for the price tag to come.

At the Third International Summit on Human Genome Editing, held in London in March, much of the discussion centred on making gene-editing therapies accessible, particularly to low- and middle-income countries. The focus was on technological approaches to streamline the production and testing of such treatments. The sickle-cell treatment, for example, requires clinicians to isolate and edit blood-forming stem cells, destroy those that remain in the body, and then reinfuse the edited cells. Converting this to a genome-editing procedure that could be performed directly in the body rather than in isolated cells could make the treatment cheaper and more accessible.

Another appealing approach is to develop gene-therapy platforms that have already been confirmed to be safe and effective. Gene-therapy developers could then just swap in a gene that targets the chosen disease, without the gamut of tests of safety and efficacy that are required when starting from scratch.

But technological solutions such as these will go only so far. US drug pricing has little to do with how much it costs to produce a therapy, says Pearson, because companies can charge as much as the market will bear. How much that price will drop in other countries could be limited by intellectual property rights and hindered by the complexities of making generic copies of biological drugs such as gene therapies. Some academic centres are trying to develop and deploy gene therapies without relying on pharmaceutical companies, but it is unclear how far such efforts can stretch without the financial resources and regulatory expertise found in industry.

In addition to pricing, gene-therapy technologies are mired in debates around regulation and intellectual property. How each of these plays out will determine how far researchers can go in capitalizing on Watson and Crick's initial discovery. It's important that scientists have an active role

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

in these debates, and that they push such discussions to the fore sooner rather than later.

Nature, 25 April 2023

https://nature.com

A sapphire Schrödinger's cat shows that quantum effects can scale up

2023-04-25

In keeping with the grand tradition of tubby cats, a newly created quantum "cat" is particularly massive — at least for the quantum realm.

Scientists put a jiggling piece of sapphire crystal in what's known as a "cat state," in which an object exists in two different states simultaneously. It's a situation reminiscent of physicists' favorite imaginary feline, Schrödinger's cat, known for being alive and dead at the same time.

The new sapphire cat is a relatively hefty 16 micrograms, physicists report in the April 21 Science. That's close to half the mass of an eyelash, and more than 100 trillion times the mass of cat states previously created with molecules. "We've reached a new regime where quantum mechanics apparently does work," says physicist Yiwen Chu of ETH Zurich.

With the mass of about half an eyelash, a hunk of crystal exists in two distinct states at once.

In a quantum parable dreamt up in the 1930s by physicist Erwin Schrödinger, a cat is trapped in a box and, due to quantum effects, winds up alive and dead at the same time (SN: 5/26/16). This paradoxical scenario doesn't happen in the real world. While quantum particles are capable of existing in two distinct states simultaneously — what's called a superposition — those effects wash out for cat-sized stuff.

Quantum effects are typically confined to atoms, molecules and the like. The everyday world visible to human eyes doesn't exhibit quantum properties. Scientists can coax certain tiny objects to display quantum features (SN: 4/25/18). But scientists don't fully understand the border between the quantum and nonquantum realms.

"We really have only just begun to understand that intermediate regime," says Benjamin Sussman of the University of Ottawa, who was not involved with the new study. "It's of really profound interest to see how these quantum systems scale and how they behave."

Cat states are a special variety of quantum behavior that come close to re-creating Schrödinger's idea. They are superpositions of two states that

are distinct according to the classical physics that describes the everyday world— like an alive or dead cat — rather than two states that exist only in the quantum domain, such as the energy levels of an atom.

In the new experiment, the researchers jiggled a portion of a sapphire crystal in such a way that its atoms moved in two directions at once. That's a distinction that "captures the spirit" of Schrödinger's cat, Chu says.

The jiggling was confined within a sliver of the crystal consisting of 100 million billion atoms. That's large enough that, if extracted from the rest of the crystal, it would be visible to the naked eye, Chu says.

Still, the oscillations of the atoms were tiny, about a millionth of a billionth of a millimeter — not exactly the scale of everyday objects. Other demonstrations of cat states have demonstrated much larger spatial separation, despite being made up of fewer atoms.

In future work, Sussman says he'd like to see the researchers scale up not only the mass, but also the size of the oscillations. "That's going to be really hard but will be really interesting."

Science News, 25 April 2023

https://sciencenews.org

Why long COVID could be a ticking time bomb for public health

2023-04-24

The 1918 influenza pandemic, commonly referred to as the Spanish Flu, infected approximately one-third (500 million) of the world's population (then 1.8 billion) and killed an estimated 50 million. With such a high mortality rate, even among young and healthy individuals, this acute infectious disease took its toll, erasing from existence nearly 3% of all people on Earth. But the damage did not stop there: across the globe, survivors of the initial viral infection reported "long flu" symptoms — profound fatigue, brain fog, depression, tremors, sleeplessness, and a litany of neurological disorders.

This "long flu," an echo of sorts of the Spanish Flu epidemic itself, has its parallel in long COVID today — a similar cluster of symptoms that persist in those who were previously infected with COVID-19. And the similarities suggest that what we think of as long COVID is not necessarily a novel condition, but merely one more instance of the medical aftermath that accompanies certain infections.

Long COVID isn't novel: other viruses in history have had similar "long" arcs — with devastating repercussions.

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

The medical establishment calls this condition post-acute infection syndrome (PAIS). Back in 1918, these mysteriously persistent long flu symptoms wreaked havoc on human health and local economies. For example, many claim that debilitating lethargy caused by this post-viral syndrome led to the "famine of corms" in the region that is Tanzania today, as farmers lacked the energy to plant, harvest, and shear months after getting sick.

Around the same time, cases of a new brain-attacking disease called encephalitis lethargica started to emerge, affecting up to one million people worldwide. The cause of encephalitis lethargica remains one of the largest medical mysteries of the 20th century, though some scientists contend that the Spanish Flu may have been the trigger. The condition was colloquially known as "sleeping sickness," as those infected developed extreme fatigue, neurocognitive impairments, psychiatric illness, and movement disorders. A subset of these individuals fell into a semi-comatose state that lasted for decades. About one-third of encephalitis lethargica patients eventually died from respiratory failure caused by neurological dysfunction, while many survivors continued to suffer from ongoing Parkinson's-disease-like (neurocognitive) symptoms.

In 1969, as chronicled in his book "Awakenings," the neurologist Oliver Sacks discovered that temporary remission of these chronic symptoms, coined post-encephalitic parkinsonism, could be achieved through the use of the Parkinson's drug L-DOPA. Like with Parkinson's disease itself, the benefits of the drug wore off over time, but the finding indicated that encephalitis lethargica impacted the substantia nigra (the part of the brain that helps control movement).

Although the medical community has long known that acute infectious diseases are not always entirely self-limiting, chronic sequelae (meaning the secondary symptoms that appear after an infection) receive little attention, remain under-researched, and continue to be misdiagnosed and overlooked by doctors. According to a study published in the scientific journal Nature Medicine, post-acute infection syndrome is associated with a number of infections, including Epstein Barr virus, cytomegalovirus, Lyme disease, Q fever, West Nile virus, Dengue fever, and the aforementioned influenza. Often presenting well after the initial infection, post-acute infection syndrome manifests as a complex and variable disorder, typically entailing severe fatigue, gastrointestinal issues, confused sensory perception, and neurocognitive abnormalities.

Despite the growing pool of data from patients suffering from post-acute infection syndrome, a comprehensive explanation of the biological mechanisms by which the syndrome's symptoms arise has yet to be established. This lack of scientific understanding creates an untold degree of hardship for those dealing with severe and chronic sequelae of infections. Worse, when doctors cannot find a biological explanation for reported symptoms, patients are often left with little recourse and the feeling that their doctor believes the cause of their suffering is rooted in mental illness.

Years into our current pandemic, we now have a plethora of information suggesting that COVID-19 is the latest addition to the list of infections spawning post-acute infection syndrome; that is, "long COVID." Multinational surveys have been conducted, with thousands upon thousands of adult participants reporting that recovery from an initial COVID infection took more than 35 weeks. Some of these studies highlight the fact that new ailments are reported 6-12 months after an initial COVID infection, which most commonly include fatigue, post-exertional malaise, and cognitive dysfunction.

According to the CDC, in June 2022, almost one in five American adults who had COVID-19 still had long COVID. This statistic seems to be borne out by my anecdotal experience; I have met with and spoken to many people around the world who have lost their sense of smell, had to take medical leave, been fired from work, seen a drop in their focus during school, experienced overwhelming exhaustion and migraines, or become depressed after being infected with COVID. My home state's newspapers recently shared the sad medical saga of a man, Charlie Vallee, whom I grew up with in Vermont. After only mild respiratory symptoms during his initial bout of COVID-19, Vallee went on to develop such severe long COVID symptoms, including brain fog, that he left his job as an intelligence officer in D.C. and tragically took his own life. His family has set up a foundation to fund long COVID research in the hopes of one day understanding how this pernicious form of post-acute infection syndrome can cause an otherwise happy and healthy individual to die by suicide.

In other words, long COVID is affecting more people than we likely know. And it eerily parallels other post-acute infection syndrome scenarios throughout history, including those potentially linked to epidemics of parkinsonism. Hence, the threat of long COVID could lead to a future public health catastrophe, much as the "long" effects of the Spanish Flu did a hundred years ago. Unfortunately, the pharmaceutical and medical community are not approaching long COVID with the same fervor that

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

they had for COVID-19. As a result, there is a real danger that a broad-scale investigation into the origin of long COVID is postponed or neglected by funding agencies and the medical establishment.

While the initial pandemic forced governments to organize a response to the sudden crisis, an epidemic of chronic illness may not raise alarms that spur us into immediate action. Like climate change, a gradually-evolving threat, especially one perceived to be far away, is much harder to address. But the threat here is not that far off, as emerging science reveals — which is why it is of grave importance that we push for an explanatory theory of long COVID (and post-acute infection syndrome) that can fully account for the totality of symptoms observed after an initial infection with SARS-CoV-2 despite no clinical findings of active infection.

The science behind long COVID

Multiple studies published in the journal Nature Communications (one published last year and one published in February of this year) explain how COVID-19 has the ability to trigger the aggregation of proteins within the human body. The research suggests that SARS-CoV-2 can cause normal proteins to abnormally misfold. These misfolded proteins are known as "amyloids," which are toxic to cells when they build up.

Specifically, amyloids occur when proteins misfold into twisted clumps and form long fibers, hindering cellular function. These so-called clumps can start stacking excessively, creating harmful deposits in the body — sort of like cholesterol in the bloodstream but at the cellular level. When misfolding of a protein named "alpha-synuclein" in the nervous system occurs, the amyloid buildup this causes in a neuron can lead to the formation of what is known as a "Lewy body," which is resistant to breakdown and clearance. Think of it as plaque buildup in the nervous system. Lewy bodies spread as pieces of these amyloids break away and seed the formation of new Lewy bodies in neighboring neurons.

The scariest thing about this? Misfolded alpha-synuclein is a hallmark of Parkinson's disease, Lewy body dementia, multiple system atrophy, and pure autonomic failure — all neurodegenerative diseases collectively known as synucleinopathies. And what can cause alpha-synuclein misfolding? Genetic mutations, exposure to certain toxins, and infections. COVID-19 may be one such infection — and that means long COVID symptoms may be a reflection of a developing neurological disorder.

Alarmingly, two studies published by the Mayo Clinic and the Medical University Innsbruck corroborate the findings in the Nature articles,

recording signs of dream-enactment sleep disorder among one-third of patients after being infected with COVID-19. Over 80% of patients with dream-enactment sleep disorder go on to develop a Parkinson's-like disease within two decades.

So we need to ask the question: is the recent rise of dream-enactment sleep disorder after COVID related to neurodegeneration? Preliminary research from Stanford University and Beth Israel Deaconess Medical Center suggests that this may be the case, as disease-causing clumps of alpha-synuclein have been discovered in some long COVID patients.

So how does all of this connect? Basically, if dream-enactment sleep disorder is more common in those who have had COVID, and the vast majority of those who suffer from this kind of sleep disorder ultimately develop neurological diseases like Parkinson's, then COVID-19 could lead to an explosion of these diseases in the coming years.

This is not mere speculation; animal models further substantiate these claims. For example, a study of macaques demonstrated that SARS-CoV-2 induces Lewy body formation (a feature of Parkinson's disease), even after an asymptomatic infection. And, whether or not COVID is determined to be a direct cause of Parkinson's, it could also accelerate the disease course in patients who are predisposed. This was exemplified by a study performed by infecting mice with COVID-19, which found that the virus made the brain more susceptible to toxic compounds known to cause Parkinson's disease. The lead researcher on this study, Richard Smeyne, PhD, who serves as Chair of the Department of Neuroscience at Thomas Jefferson University and Director of the Jefferson Comprehensive Movement Disorder Center reviewed this article before publication, affirming what has been outlined and reiterating his study's findings: "Should the predicted risk from SARS-CoV-2 manifest, the diverse consequences would represent a substantial burden on patients, families, and society."

Dr. Smeyne elaborated on the seriousness of these findings, telling Salon, "Our studies in mice predict a 30-50% increase in Parkinson's risk for those moderately to severely infected with the Alpha variant. While on an individual basis this only changes a person's risk from 2% to 3% for developing Parkinson's, over the whole of the population we would expect to see millions more develop Parkinon's disease than would have if not for their COVID infection."

A prominent theory for explaining Parkinson's disease, put forth by Heiko Braak, a German doctor who studies Parkinson's, aligns well with

CHEMWATCH
Bulletin Board
Curiosities
MAY. 05, 2023

all these long COVID findings. It states that Parkinson's is caused by a pathogen affecting either the nasal cavity or digestive system, thereby first initiating protein misfolding in the peripheral nervous system before spreading into the brain later on (sometimes decades later). This is why the onset of Parkinson's often entails autonomic dysfunction — which means involuntary processes like heart rate, blood pressure, respiration, etc. are compromised. As autonomic dysfunction is a common symptom of long COVID, it is thus possible that the post-acute infection syndrome mechanism responsible for long COVID progresses to the central nervous system over time and could eventually present as Parkinson's disease or a similar disorder.

In other words, while long COVID is not caused by the lingering viral remnants of COVID-19 per se, the initial infection could be precipitating amyloid buildup and Lewy body formation. If this is so, long COVID would mimic a chronic or slowly-evolving infection caused by the virus, similar to other post-acute infection syndrome cases, with the symptoms fluctuating and emerging unpredictably as the amyloids slowly spread throughout the nervous system.

Braak's hypothesis was based on autopsy data, which indicated a distinct pattern of aggregated alpha-synuclein in those who died from/with Parkinson's disease. However, according to Dr. Smeyne, "As of yet, there is no good non-invasive marker for alpha-synuclein aggregation in living patients, which is why The Michael J. Fox Foundation is offering a $2 million prize to any person or group that successfully develops such a marker."

The way forward

To investigate these claims, larger studies need to evaluate patients with long COVID for markers of Parkinson's-like diseases, such as misfolded alpha-synuclein. A clinical trial is currently underway to do just that — so that the history of post-encephalitic parkinsonism in the years following the Spanish Flu does not repeat itself. Considering the mounting evidence, it is crucial that we address the long COVID public health emergency promptly, to provide answers to those suffering from long COVID and prevent a potential increase in "post-COVID parkinsonism."

When asked about his outlook for the future, Dr. Smeyne said, "We are entering a period where we will have to learn to live with COVID being present as a fact of life. This means we still have to examine if the newer strains of SARS-CoV-2 also have the potential to increase the risk for Parkinson's disease and whether vaccination against this virus can reduce

the increased Parkinson's risk, as has been shown following vaccination against influenza. Once we determine the answers to these questions, we can begin to look at other ways to interfere with the process."

Salon then asked what it will take to definitively prove whether COVID-19 can trigger a Parkinson's-like disease and whether long COVID is in fact the early stages of such a disease. Dr. Smeyne responded, "My best guess is we will need anywhere from five to ten years from the initial outbreak to see any statistically measurable effect."

Encouragingly, Dr. Smeyne went on to say, "One bright spot in these observations is that there is a considerable period, often about a decade, between viral exposure and the development of a neurological disease like Parkinson's. And there are currently scientists devoting their lives' efforts to find ways to solve this problem — the lag between exposure and disease gives me hope that we will find a way to stop the progression from infection to disease in its tracks."

There have been more than 760 million globally documented cases of COVID-19, with the real number of cases, including asymptomatic cases, presumably much higher. More than 750 million have survived, but, as reported, long COVID is occurring in 20-30% of these cases, meaning that hundreds of millions of people could be at higher risk of developing Parkinson's disease or other neurodegenerative issues later in life. If it comes to pass, the public health resources required to help will be astronomical. It behooves us to study long COVID now, lest we end up in such a crisis.

Salon, 24 April 2023

https://salon.com

CHEMWATCH
Bulletin Board

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

CHEMICAL EFFECTS

Arsenic exposure incurs hyperglycemia mediated by oxidative damage in urban adult population: A prospective cohort study with three repeated measures

Micro/nanoscale bone char alleviates cadmium toxicity and boosts rice growth via positively altering the rhizosphere and endophytic microbial community

Evaluating non-targeted analysis methods for chemical characterization of organic contaminants in different matrices to estimate children's exposure

ENVIRONMENTAL RESEARCH

Impacts of anthropogenic discharge on distribution, mass budget, and long-term risk of total mercury in coastal region: A case study of the Jiaozhou Bay, China

Air pollution and stroke; effect modification by sociodemographic and environmental factors. A cohort study from Denmark

Potentially toxic elements in the environment - a review of sources, sinks, pathways and mitigation measures

Occurrence and ecological risk assessment of organophosphate esters in surface water from rivers and lakes in urban Hanoi, Vietnam

PHARMACEUTICAL/TOXICOLOGY

Fate of five bisphenol derivatives in Chlamydomonas mexicana: Toxicity, removal, biotransformation and microalgal metabolism

OCCUPATIONAL

Occupational exposure to pesticides as a potential risk factor for epilepsy

Occupational health and safety, metal exposures and multi-exposures health risk in Canadian electronic waste recycling facilities