

Bulletin Board

Contents

OCT. 21, 2022

(click on page numbers for links)

REGULATORY UPDATE

ASIA PACIFIC

Japan Updates SDS and Labelling Guidance under PRTR Law.....	4
Taiwan to Add 4 New Organotin Compounds as Toxic Chemicals.....	4
China Issues Draft List of New Pollutants for Priority Management (2022 Version)	5

AMERICA

Americans actually agree on something — they want products free of harmful chemicals.....	5
DC sues chemical manufacturer over pesticide pollution	6
FDA leaders say the agency is 'focused on food'.....	7
Toxic PFAS pollution is likely at more than 57,000 US locations: Report.....	8
Big Pharma Is Flooding Puerto Rico With Toxic Waste	9

EUROPE

EFSA Draft Scientific Opinion on the human health risks related to the presence of N-nitrosamines (N-NAs) in food	10
Just How Safe Are Cosmetics On The European Market?	11
Upcoming GB active substance renewal submission deadlines.....	12
Upcoming GB active substance expiry dates.....	14

INTERNATIONAL

Russia to Implement New GHS Standards in 2023.....	15
--	----

REACH UPDATE

Commission non-committal over chemicals regulation revision timeline	16
Echa Regulation should allow use of external experts, industry urges.....	17

JANET'S CORNER

The Future of Medicine	19
------------------------------	----

GOSSIP

Light-based therapy weakens antibiotic-resistant bacteria.....	20
--	----

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.**

Bulletin Board

Contents

OCT. 21, 2022

A Common Medicine Causes Hearing Loss – Scientists Finally Might Know Why	22
The Mediterranean Sea Is So Hot, It's Forming Carbonate Crystals	23
World-first stem cell therapy trial treats spina bifida before birth	26
Oil-eating microbes excrete the world's cheapest "clean" hydrogen	27
Efficient new catalyst converts mixed plastic waste into propane	30
Scientists develop a new printable, wearable insect repellent	31
Early Mars may have been home to methane-producing microbes which caused climate cooling	32
Scientists Discover a Previously Unknown Plant Mechanism – And Its Impact Could Be Enormous	34
Wildlife populations plunge 69% since 1970: WWF	36

CURIOSITIES

Sorry to break it to you, but low-sugar booze is still bad for you	39
Eureka! Finally, the Real Answer Why Your Best Ideas Come in the Shower	41
Evolution in action as frogs in Chernobyl exclusion zone turn black.....	44
Artificial Superstrong Silkworm Silk Is 70% Stronger Than Spider Silk.....	46
First step for Australian biologists as study begins to grow durable and sustainable plants in space	47
The Amazon Rainforest Is in Bigger Danger Than We Thought.....	49
New Discoveries Could Reveal the Nature of Dark Matter	51
Neurons in a dish learn to play Pong — what's next?.....	54
'Smart plastic' material is step forward toward soft, flexible robotics and electronics.....	56
Astronomers can't explain a black hole "burp" years after it ate a star	57

TECHNICAL NOTES

(Note: Open your Web Browser and click on Heading to link to section) ...	59
CHEMICAL EFFECTS	59
ENVIRONMENTAL RESEARCH	59
PHARMACEUTICAL/TOXICOLOGY	59
OCCUPATIONAL.....	59

Bulletin Board

Regulatory Update

OCT. 21, 2022

ASIA PACIFIC

Japan Updates SDS and Labelling Guidance under PRTR Law

2022-10-13

In October 2022, the Japanese Ministry of Economy, Trade, and Industry (METI) updated its comprehensive guidance on labelling and SDS preparation under the PRTR Law. The guidance in Japanese is now available on the METI website.

Read More

Chemlinked, 13-10-22

<https://chemical.chemlinked.com/news/chemical-news/japan-updates-sds-and-labelling-guidance-under-prtr-law>

Taiwan to Add 4 New Organotin Compounds as Toxic Chemicals

2022-10-13

On October 4, 2022, Taiwan's EPA issued a notice to commence a period of public comments for the Draft Amendments to Categories and Management of Handling for Toxic Chemical Substance (hereinafter referred to as the Draft Amendments) under Taiwan TCSCA. The Draft Amendments proposed to update the toxicity classification and handling requirements of 10 existing organotin compounds and add 4 new organotin compounds as toxic chemicals. Once approved, a grace period of 1~2 year(s) will be provided for enterprises to comply with the corresponding requirements. Comments are welcome before November 3, 2022.

Read More

Chemlinked, 13-10-22

<https://chemical.chemlinked.com/news/chemical-news/taiwan-to-update-categories-and-management-of-handling-for-organotin-compounds>

Taiwan EPA to strengthen source control and use safety of organotin compounds.

Bulletin Board

Regulatory Update

OCT. 21, 2022

China Issues Draft List of New Pollutants for Priority Management (2022 Version)

2022-10-13

On September 27, 2022, the Chinese Ministry of Ecology and Environment released a notice to solicit public comments for the Draft List of New Pollutants for Priority Management (2022) (hereinafter referred to as “2022 Draft”). The 2022 Draft contains 14 types of new pollutants, specifying their names, CAS numbers and major environmental risk control measures. Comments are welcome before October 28, 2022. The official list is expected to be made public by the end of 2022 as scheduled in the Action Plan for New Pollutants Treatment.

Read More

Chemlinked, 13-10-22

<https://chemical.chemlinked.com/news/chemical-news/china-issues-draft-list-of-new-pollutants-for-priority-management-2022-version>

AMERICA

Americans actually agree on something — they want products free of harmful chemicals

2022-10-12

As we near midterm elections, a new poll has done the unthinkable: found an issue that doesn't divide us.

Americans want government and industry to get harmful chemicals out of our products, according to a survey of 1,200 registered voters commissioned by the Program on Reproductive Health and the Environment at the University of California, San Francisco. More than 90% of those surveyed supported the notion that the government should require products be proven safe before they are put on the market.

“At a time when most issues are politically polarized, the issue of keeping people safe from harmful chemicals finds widespread agreement among Democrats, Republicans and Independent voters,” said Celinda Lake — president of Lake Research Partners, which conducted the poll — in a statement.

Bulletin Board

Regulatory Update

OCT. 21, 2022

Read More

Environmental Health News, 12-10-22

<https://www.ehn.org/support-for-chemical-regulation-2658439235.html>

DC sues chemical manufacturer over pesticide pollution

2022-10-14

The District of Columbia filed a lawsuit in D.C. Superior Court Thursday against chemical manufacturer Velsicol Chemical, LLC, claiming it violated city environmental laws by polluting a major waterway, the Anacostia River and the surrounding area for decades.

In a complaint filed by D.C. Attorney General Karl Racine, the city alleges that Velsicol produced a pesticide that contained chlordane and marketed it to low-income homeowners in the city from 1945 to 1988. That was the year the chemical was banned for sale in the U.S. by the Environmental Protection Agency over health effects in humans, including tremors, convulsions and cancer.

But Racine claimed at a press conference that Velsicol knew long before that that chlordane could cause cancer, as far back as 1959, yet still sold products that contained the chemical.

Velsicol did not immediately return calls for comment.

As recently as the 1960s, D.C. residents used the Anacostia River for recreation and food, but years of pollution from a variety of sources — sewage, chemical runoff and litter — made the river unusable.

The lawsuit developed out of a decades-long effort to clean up the river, Racine said. Local environmentalists, like Matt Gravatt, chair of the D.C. chapter of the Sierra Club, said the river is almost back to being safe for public use, but not yet.

City departments and environmental researchers have known about the potential harm of chlordane in the Anacostia for decades. The year after the EPA ban, the district put out an advisory warning residents against eating fish caught from the river, in part because levels of chlordane in aquatic life exceeded limits suggested by the Food and Drug Administration.

Bulletin Board

Regulatory Update

OCT. 21, 2022

Read More

WBOC, 14-10-22

https://www.wboc.com/news/national/dc-sues-chemical-manufacturer-over-pesticide-pollution/article_27083776-df32-576d-b26e-dff73065ed74.html

FDA leaders say the agency is 'focused on food'

2022-10-13

FDA Commissioner Robert Califf opened Wednesday's National Food Policy Conference with some sobering words.

"It's all too obvious that we're in the midst of backsliding in the progress that we've made for many years," Califf said.

The average American's life expectancy has gone down nearly three years since 2019 and is now 76.1 years, the lowest level since 1996, he said. Six in 10 people in this country have a chronic disease, and four in 10 have more than one.

Many factors contribute to these conditions, but unhealthy diets and poor nutrition play an outsized role, Califf said. Three-quarters of people in the U.S. don't eat enough fruits, vegetables or dairy, he said, while a majority eat too much sugar, salt and saturated fat.

But this week, he said the nation is at an inflection point in food policy.

Last month, President Joe Biden hosted the first White House Conference on Hunger, Nutrition and Health in more than 50 years. The administration released a detailed policy plan designed to end hunger in the nation by 2030, as well as reverse trends toward more diet-related diseases.

Read More

Food Dive, 13-10-22

<https://www.fooddive.com/news/fda-food-priority-robert-califf-susan-mayne/633966/>

Commissioner Robert Califf and safety and nutrition head Susan Mayne told a conference this week how they plan to use policy to improve what people eat amid unhealthy diets and poor nutrition.

Bulletin Board

Regulatory Update

OCT. 21, 2022

Toxic PFAS pollution is likely at more than 57,000 US locations: Report

2022-10-13

Toxic PFAS have likely contaminated roughly 57,412 locations across the U.S., according to a new study.

Those locations include certain industrial facilities, waste processing facilities, and places where firefighting foam containing PFAS (per- and polyfluoroalkyl substances) have been used, such as airports and military bases.

The study, published today in the journal *Environmental Science & Technology Letters*, found likely PFAS contamination sites in all 50 states. It is the first study to use existing scientific data on PFAS contamination to create a model that can predict locations where contamination is likely.

"PFAS contamination at these sites is not just possible, but probable," Alissa Cordner, senior author on the paper and co-director of the PFAS Project Lab, told EHN. "Testing for PFAS is extremely expensive and requires a lot of time and technical capacity... One of our big goals is to help decision makers prioritize testing and remediation at these locations based on this high likelihood of contamination."

PFAS don't break down naturally, so they linger in the environment and human bodies. Exposure is linked to health problems including kidney and testicular cancer, liver and thyroid problems, reproductive problems, lowered vaccine efficacy in children and increased risk of birth defects, among others.

The chemicals have been found in drinking water systems throughout the U.S., in the bodies of humans and animals around the globe, in plants and crops, and even in rainwater at levels too high for safe consumption.

Research on the chemicals has increased in recent years, but due to a lack of testing requirements at the federal level, we lack critical data about the scale, scope, and severity of PFAS releases and contamination in the U.S.

Read More

Environmental Health News, 13-10-22

<https://www.ehn.org/pfas-across-the-united-states-2658444760.html>

Bulletin Board

Regulatory Update

OCT. 21, 2022

Big Pharma Is Flooding Puerto Rico With Toxic Waste

2022-10-13

In Puerto Rico, cheap labor and generous tax breaks—since 2017, more than \$100 billion worth—have made US-based pharmaceutical firms the biggest economic players in town. Drug manufacturers have brought in tens of thousands of jobs, albeit with a tax-break price tag of more than \$1 million each. But a new report by the nonprofit Center for Popular Democracy and advocacy group Hedge Clippers suggests that Big Pharma's footprint on the island has come with other serious costs: illegal dumping of toxic waste, pollution and depletion of groundwater, and violations of other vital Environmental Protection Agency regulations. The report, released Tuesday, paints a disturbing picture, holding US pharmaceutical corporations at least partially responsible for Puerto Rico's disproportionately high rates of asthma and cancer. The sum of its findings: a pattern of environmental racism resulting in more than a dozen Big Pharma-related Superfund sites, with the complicity of federal and local authorities.

Puerto Rico is home to some 500 EPA-designated, toxin-packed Superfund sites, half of which were "active" as of July, meaning they pose an ongoing risk to the surrounding communities and ecosystems. Eighteen of its active sites are on the EPA's "national priorities list," which tracks areas most likely to release harmful compounds; of those, 15 are linked to the pharmaceutical industry. And Superfund sites don't include every area where industries have improperly disposed of hazardous waste—just the most serious health and environmental threats.

Read More

Mother Jones, 13-10-22

<https://www.motherjones.com/environment/2022/10/big-pharma-is-flooding-puerto-rico-with-toxic-waste/>

Bulletin Board

Regulatory Update

OCT. 21, 2022

EUROPE

EFSA Draft Scientific Opinion on the human health risks related to the presence of N-nitrosamines (N-NAs) in food

2022-10-12

EFSA's Panel on Contaminants in the Food Chain (CONTAM) has launched a public consultation on the draft scientific opinion on the risks for animal health related to the presence of nitrosamines in food. This document presents an evaluation of the toxicity of N-nitrosamines, the estimated dietary exposure of European citizens to the carcinogenic nitrosamines present in food and, based on these, the risk assessment of the health risks to the EU population. Interested parties are invited to submit their comments by the indicated deadline. When submitting the comments, specific reference to the line and page numbers to which the comments relate must be made.

Additional data or files to support the comments may be submitted using the relevant function in the digital form. The name of any attached file shall include reference to the comment it refers to (e.g. comment identifier, topic, etc.). The file shall be in a searchable format and accessible to allow downloading. Scanned documents will not be considered. [If data on chemical contaminants are submitted to support a comment, these must be submitted in SSD format to the EFSA Data Collection Framework (DCF) via the call for collection of chemical contaminants occurrence data in food and feed. Please contact data.collection@efsa.europa.eu for further information and to receive the access credentials for the DCF web interface.] Comments will be considered as long as they: • are submitted by the closing date of the consultation; • are finalised (comments in "draft" status will not be accepted); • are presented according to the instructions and relevant function in the tool (regrettably, we cannot accept comments sent by e-mail); Comments containing personal accusations, irrelevant or offensive statements or material will not be considered. Copyright-cleared contributions: Persons or organizations participating in a public consultation of EFSA are responsible for ensuring that they hold all the rights necessary for their submissions and subsequent publication by EFSA.

Comments should inter alia be copyright-cleared considering EFSA's transparency policy and practice to publish all submissions. In case the submission reproduces third-party content in the form of charts, graphs

Bulletin Board

Regulatory Update

OCT. 21, 2022

or images, the required prior permissions of the right holder(s) should have been obtained by the public consultation respondent. Publication of contributions: Third-party comments will be made public in their original form without delay after the closing date of the consultation and may be reused by EFSA in a different context. The outcome of the consultation will be made public in conjunction with the publication of the relevant scientific output. Contributions submitted by individuals in a personal capacity will be published indicating the author's first and family name, unless the respondent has requested anonymity. Contributions submitted on behalf of an organization will be attributed to the organization in question. Should anonymity be requested, the requestor shall make sure that he/she is not identifiable either from any comments made in the reply or from any file attachment. PC comments and file attachments are published in the original form without further editing and EFSA is not responsible for the fact that individuals may be identifiable from these, also in case they requested anonymity.

Read More

EFSA, 12-10-22

<https://connect.efsa.europa.eu/RM/s/publicconsultation2/a017U0000011jEt/pc0278>

Just How Safe Are Cosmetics On The European Market?

2022-10-13

When was the last time you read the ingredient label on a bottle of shampoo? Have you ever sneezed when applying face powder? As you lay on the beach this summer, did you wonder what it was in your sunscreen that blocked the sun's UV light and protected your skin?

A large number of chemical substances are used in many such products. The HBO documentary series investigates harmful chemicals used in the beauty industry and centres, in particular, on the experiences of consumers and workers who say that they were exposed to harmful substances in personal-hygiene products. Above all, it is a chilling exposé of the lack of regulation of cosmetics in the United States.

According to the (FDA), the United States has only banned 11 harmful substances in cosmetic products. By comparison, the European Union (EU), prohibits more than 1,300 substances, and restricts more than 250 with a concentration threshold.

Bulletin Board

Regulatory Update

OCT. 21, 2022

The United States is one of the world's largest markets of the cosmetics industry. Studies have confirmed that women tend to consume cosmetics and personal-hygiene products much more than men and tend to account for the vast majority of workers (90%) in professional beauty services such as hair and nail salons.

Some interviewed in the series claim to have contracted, a cancer that affects tissue surrounding bodily organs, due to asbestos detected in talc and make-up. Others explain they have suffered fertility problems and even miscarriages as a result of exposure to "everyday chemicals" upsetting hormones, formally known as endocrine disruptors. These include bisphenol A (BPA), which can be found in eye make-up and nail varnish, or phthalates, which keep nail polish from cracking and help the scent of perfumes linger.

Read More

MENAFN, 13-10-22

<https://menafn.com/1105014554/Just-How-Safe-Are-Cosmetics-On-The-European-Market>

Upcoming GB active substance renewal submission deadlines

2022-10-13

Under the GB BPR, active substance approvals will expire unless a renewal application is submitted at least 550 days before their expiry date.

The 550-day deadlines are coming up for the following active substance/product type combinations under GB BPR:

- (3 β ,5Z,7E)-9,10-secocholesta-5,7,10(19)-trien-3-ol (Cholecalciferol) (CAS 67-97-0 EC 200-673-2) in product type 14
28 December 2022
- (RS)-4-hydroxy-3-(3-oxo-1-phenylbutyl)coumarin (Warfarin) (CAS 81-81-2 EC 201-377-6) in product type 14
28 December 2022
- 3-(3-biphenyl-4-yl-1,2,3,4-tetrahydro-1-naphthyl)-4-hydroxycoumarin (Difenacoum) (CAS 56073-07-5 EC 259-978-4) in product type 14
28 December 2022

Apply for active substance renewal by the deadlines to keep products on the GB market

Bulletin Board

Regulatory Update

OCT. 21, 2022

- 3-[3-(4'-Bromo[1,1'-biphenyl]-4-yl)-3-hydroxy-1-phenylpropyl]-4-hydroxy-2H-1-benzopyran-2-one (Bromadiolone) (CAS 28772-56-7 EC 249-205-914) in product type 14
28 December 2022
- 3-[3-(4'-bromo[1,1'-biphenyl]-4-yl)-1,2,3,4-tetrahydronaphth-1-yl]-4-hydroxy-2H-1-benzothiopyran-2-one (Difethialone) (CAS 104653-34-1 EC n/a) in product type 14
28 December 2022
- 3-[3-(4'-bromobiphenyl-4-yl)-1,2,3,4-tetrahydro-1-naphthyl]-4-hydroxycoumarin (Brodifacoum) (CAS 56073-10-0 EC 259-980-5) in product type 14
28 December 2022
- 4-hydroxy-3-[(1RS,3RS;1RS,3RS)-1,2,3,4-tetrahydro-3-[4-(4-trifluoromethylbenzyloxy)phenyl]-1-naphthyl]coumarin (Flocoumafen) (CAS 90035-08-8 EC 421-960-014) in product type 14
28 December 2022
- Chlorophacinone (CAS 3691-35-8 EC 223-003-0) in product type 14
28 December 2022
- Coumatetralyl (CAS 5836-29-3 EC 227-424-0) in product type 14
28 December 2022
- Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1600 and a mean polydispersity (PDI) of 1.8 (PHMB (1600;1.8)) (CAS 27083-27-8 / 32289-58-0 EC n/a) in product types 2, 3 and 11
28 December 2022
- cis-Tricos-9-ene, (Z)-Tricos-9-ene (Muscalure) (CAS 27519-02-4 EC 248-505-7) in product type 19
30 March 2023
- Hydrogen cyanide (CAS 74-90-8 EC 200-821-6) in product types 8, 14 and 18
30 March 2023
- 4-bromo-2-(4-chlorophenyl)-5-(trifluoromethyl)-1H-pyrrole-3-carbonitrile (Tralopyril) (CAS 122454-29-9 EC n/a) in product type 21
28 September 2023

Bulletin Board

Regulatory Update

OCT. 21, 2022

- Nonanoic acid (Pelargonic acid) (CAS 112-05-0 EC 203-931-2) in product type 2
29 March 2024

Any person, company or taskforce/consortium can support an active substance/product type combination for renewal – it doesn't have to be the original supporter.

Check the GB Article 95 List to see who the original supporters were.

If a renewal application is not submitted for the above active substance/product type combinations under GB BPR, the approvals will expire. This means the active substances can no longer be used in biocidal products of the relevant product types in Great Britain.

Read More

HSE.gov.uk, 13-10-22

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

Upcoming GB active substance expiry dates

2022-10-13

The active substance/product type combinations listed below are due to expire under the GB BPR on the following dates:

- Cyclohexylhydroxydiazene 1-oxide, potassium salt (K-HDO) (CAS 66603-10-9 EC n/a) in product type 8
31 December 2022
- (±)-5-amino-1-(2,6-dichloro-α,α,α-trifluoro-p-tolyl)-4-trifluoromethylsulfinylpyrazole-3-carbonitrile (1:1) (Fipronil) (CAS 120068-37-3 EC 424-610-5) in product type 18
30 September 2023

Once the approvals expire, the active substances can no longer be used in biocidal products of the relevant product types in Great Britain.

Read More

HSE.gov.uk, 13-10-22

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

**Biocidal products
must be phased off
the GB market**

Bulletin Board

Regulatory Update

OCT. 21, 2022

INTERNATIONAL

Russia to Implement New GHS Standards in 2023

2022-10-11

On July 19, 2022, the Coordinating Informational Center of CIS Member States on Approximation of Regulatory Practices (CIS Center) released three new standards as Russian national standards, establishing requirements for hazard classification, safety data sheet (SDS) and labelling in accordance with the 7th revised edition of UN GHS (Globally Harmonized System of Hazard Classification and Labeling of Chemicals). The new standards are scheduled to take effect from January 1, 2023.

The three new GHS standards have been adopted through Russian Federal Agency for Technical Regulation and Metrology (Rosstandart) orders as follows:

1. GOST 32419-2022 Classification of Chemical Hazards. General Requirements.
2. GOST 30333-2022 Chemical Production Safety Data Sheet. General Requirements.
3. GOST 31340-2022 Warning Labels of Chemical Products. General Requirements.

Read More

Chemlinked, 11-10-22

<https://chemical.chemlinked.com/news/chemical-news/russia-to-implement-new-ghs-standards-in-2023>

Bulletin Board

REACH Update

OCT. 21, 2022

Commission non-committal over chemicals regulation revision timeline

2022-10-13

The European Commission has declined to commit to moving forward with the delayed revision of the regulation on chemicals on the back of a deepening rift between the socialists and the centre-right groups of the European Parliament over the issue.

The revision of the regulation for evaluating and authorising chemicals (REACH) was announced as part of the Commission's chemicals strategy for sustainability and was originally pencilled in for the end of 2022.

The amendment is intended to align the EU chemical rules with the Commission's ambition for safe and sustainable chemicals and a high level of protection of health and the environment, while also preserving the internal market.

After suffering a number of delays, the new framework, which will impact a wide range of chemicals, from pesticides to polymers used to create plastic materials, is now expected to come in 2023.

Asked whether the revision would proceed as planned, a Commission official told EURACTIV that, as the Commission Work Programme 2023 is being finalised, they "cannot confirm neither planning nor proposals for next year".

While the official stopped short of committing to this timeline, they assured that the Commission will update its relevant web page "accordingly in the coming weeks to inform stakeholders and the public about the updated planning of the proposal."

Meanwhile, the impact assessment accompanying the targeted REACH review is currently being finalised, the official added.

Read More

Euractiv, 13-10-22

<https://www.euractiv.com/section/agriculture-food/news/commission-non-committal-over-chemicals-regulation-revision-timeline/>

Bulletin Board

REACH Update

OCT. 21, 2022

Echa Regulation should allow use of external experts, industry urges

2022-10-13

The European Commission's proposal for a new standalone Regulation to redefine Echa's financing and operating model should support the use of external experts to account for the agency's increasing mandate, industry groups have said.

Echa's committees, such as those for risk assessment (Rac), socio-economic analysis (Seac) and the member state committee (MSC), have a "very high workload" that is set to increase further under the EU's chemicals strategy for sustainability (CSS), Cefic and the American Chemistry Council (ACC) said in response to a Commission consultation on the proposal.

Cefic said the diversity and complexity of tasks the committees must cover has increased over the years, requiring a broad range of expertise. The Regulation should therefore "facilitate the use of external expertise" to support them, particularly the Rac. For example, support could be provided on the use of epidemiological and exposure data, mechanism of action and the assessment of mobility or endocrine disruption.

Such topics could involve external experts on a "need to have" basis, independent of their affiliation, it said.

"This way of working could be institutionalised by allowing temporary project-related appointments of committee members with expertise in a specific area, complementing the current appointment of committee members nominated by member states," Cefic added.

The ACC echoed the call, saying a basic regulation should afford Echa the flexibility to appoint experts needed to support committees, such as external experts temporarily appointed to address a specific area.

'Reliable, relevant expertise'

Metals trade association Eurometaux added that Echa committees often proceed without adequate expertise, which is not "fit for purpose".

"Access to representative, reliable and relevant expertise is key for the efficient performance of any assessment task," it said.

Experts with current or former industry connections are often excluded based on a "default assumption of conflict of interest", Eurometaux added.

Bulletin Board

REACH Update

OCT. 21, 2022

Industry experts should be given a comparable level of recognition during the identification and selection of experts as the ones from authorities/ academic institutions, it added.

Fees

The new Regulation will also set up a sustainable financial framework for Echa. According to the Commission, this budget could be supported by new revenue sources, "such as new fee types on certain operations related to the manufacturing, import or use of chemicals, reflecting the work carried out by Echa."

Read More

Chemical Watch, 13-10-22

<https://chemicalwatch.com/585085/echa-regulation-should-allow-use-of-external-experts-industry-urges>

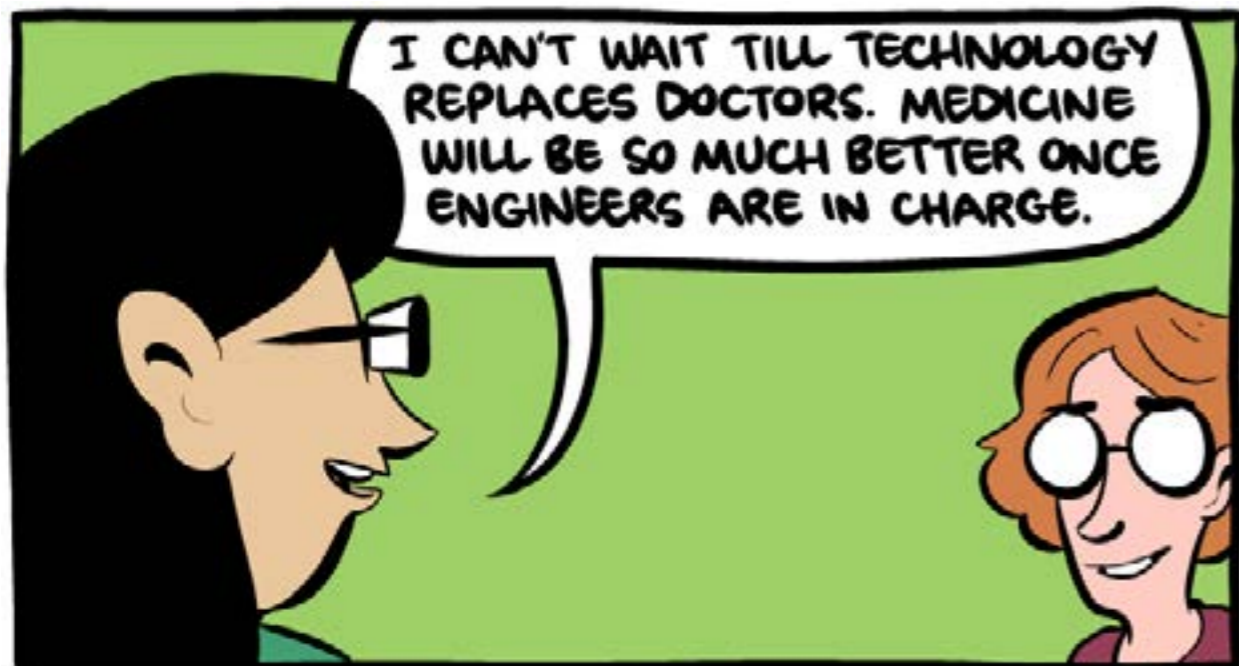
Bulletin Board

Janet's Corner

OCT. 21, 2022

The Future of Medicine

2022-10-21



smbc-comics.com

<https://www.smbc-comics.com/comic/the-future-of-medicine>

Bulletin Board

Gossip

OCT. 21, 2022

Light-based therapy weakens antibiotic-resistant bacteria

2022-10-07

Antibiotics are standard treatments for fighting dangerous bacterial infections. Yet the number of bacteria developing a resistance to antibiotics is increasing. Researchers from Texas A&M University and the University of São Paulo are overcoming this resistance with light.

The researchers tailored antimicrobial photodynamic therapy (aPDT)—a chemical reaction triggered by visible light—for use on antibiotic-resistant bacteria strains. Results showed the treatment weakened bacteria to where low doses of current antibiotics could effectively eliminate them.

“Using aPDT in combination with antibiotics creates a synergy of interaction working together for a solution,” said Vladislav Yakovlev, University Professor in the Department of Biomedical Engineering at Texas A&M and co-director of the project. “It’s a step in the right direction against resistant bacteria.”

The research results were published in Proceedings of the National Academy of Sciences (PNAS).

Ultraviolet light was first used to sterilize bacteria over 100 years ago. The treatment was based on the work of Niels Finsen, who won the Nobel Prize in Physiology in 1903 for using filtered sunlight—the higher frequency or ultraviolet spectrum—as a cure for skin tuberculosis. Phototherapy advances faded in popularity a few decades later when antibiotics became the weapon of choice against bacteria.

Antibiotic-resistant bacteria showed up soon after antibiotics were first used. If antibiotic treatment stops before bacteria are fully killed, the remaining bacteria develop a resistance or immunity to the antibiotic. That immunity transfers to every new bacteria cell, so more potent antibiotics or new treatment methods are needed to overcome the growing resistance.

“Photodynamic therapy was a forgotten tool,” Yakovlev said. “Yet, bacteria cannot overcome it. There is no resistance.”

Some human cancer cell therapies already use aPDT to prevent the growth of abnormal cells, but treating resistant bacteria with it is still a novel approach.

“Photodynamic therapy was a forgotten tool,” Yakovlev said. “Yet, bacteria cannot overcome it. There is no resistance.”

Bulletin Board

Gossip

OCT. 21, 2022

The researchers began their work by choosing the bacteria and the three main parts of aPDT needed to combat it: molecular oxygen, light, and a photosensitizer—something that creates a reaction between oxygen and light. An already FDA-approved dye called methylene blue served as the photosensitizer. The light sources were specially constructed panels of 25 LEDs in reflective cones built by the Technical Support Laboratory of the São Carlos Institute of Physics. Methicillin-resistant *Staphylococcus aureus* served as the bacteria, and the researchers grew cultures with the blue dye in them to ensure the photosensitizer alone would not affect the bacteria.

Most of the lab work occurred in the Texas A&M Health Science Center under Paul de Figueiredo, professor in the Department of Microbial Pathogenesis and Immunology in the College of Medicine.

At first, the team used aPDT by itself at various light strengths, durations, and in a specific series of follow-up treatments to log the bacteria's response. The idea was to find the lowest dose and shortest series that could weaken the bacterial membranes and other resistance mechanisms. Cell recoveries and reproductions revealed how many generations it took before antibiotic resistance returned. Next, the researchers added measured levels and combinations of antibiotics at different time intervals after aPDT treatments to note the weakened bacteria's responses.

"The use of antibiotics with aPDT is a unique idea," Yakovlev said. "We can use lower doses of both to achieve our goal in contrast to using one or the other at higher doses that could have side effects."

The goal is to shorten the treatment time and reduce the dosage to the lowest levels needed.

Getting medical care down to one doctor visit is especially important to Vanderlei Bagnato, professor in the Department of Physics and Materials Science at São Paulo and co-director of the project. He is trying to improve recovery odds for populations in remote areas of Brazil where patients might only see a doctor once per illness, without any chance for follow-up care.

The U.S. Department of Defense is following the project closely because battlefield wound infections also happen in remote locations and must be dealt with quickly.

So far, the results are positive. The resistant bacteria, weakened by aPDT treatments, were killed with far lower doses of current antibiotics. As a benefit, these therapies reduced the need for battling resistant

Bulletin Board

Gossip

OCT. 21, 2022

bacteria with more potent and expensive antibiotics that take years to produce. Future work for the project will involve more timing and dosage investigations and tests on other resistant bacteria strains to see if the effectiveness is universal.

"Imagine the real-life applications," Yakovlev said. "You visit a doctor, who uses an ointment and shines a light on the infected area, and then you're done. It would be a quick and harmless treatment as needed."

Phys Org, 7 October 2022

<https://phys.org>

A Common Medicine Causes Hearing Loss – Scientists Finally Might Know Why

2022-10-06

Researchers at Indiana University School of Medicine are exploring new methods to investigate why an antibiotic causes hair cell death and permanent hearing loss in humans.

In a study that was published in the journal *Developmental Cell*, the researchers described how they identified the autophagy pathway in hair cells that is connected to the permanent hearing loss caused by the antibiotic class aminoglycosides. The researchers also created one of the first model systems that is insusceptible to hearing loss caused by aminoglycosides.

"This work identifies multiple potential therapeutic targets for preventing hearing loss caused by aminoglycosides," said Bo Zhao, Ph.D., assistant professor of otolaryngology—head and neck surgery.

One of the primary causes of hearing loss in people is ototoxicity, or hearing loss brought on by medication. In the United States alone, hearing loss affects more than 48 million individuals.

For over a century, serious infections have been treated using aminoglycosides. Although the drug is a first-line treatment for life-threatening infections because of its cheap cost and low incidence of antibiotic resistance, it has been shown to cause hair cell death and subsequent permanent hearing loss in 20-47% of patients, although the underlying processes remain unknown. Hair cells are responsible for sound reception in the inner ear.

One of the primary causes of hearing loss in people is ototoxicity, or hearing loss brought on by medication. In the United States alone, hearing loss affects more than 48 million individuals.

Bulletin Board

Gossip

OCT. 21, 2022

Zhao, whose lab investigates the molecular mechanisms underlying hearing loss, used biochemical screening to identify proteins found in hair cells. They first discovered that aminoglycosides are bound to the protein RIPOR2, which is required for auditory perception.

“As aminoglycosides specifically trigger a rapid localization change of RIPOR2 in hair cells, we hypothesize that RIPOR2 is essential for aminoglycoside-induced hair cell death,” Zhao said.

The researchers developed a model in the lab that has normal hearing but significantly decreased RIPOR2 expression. Through these experiments, Zhao said the model had neither significant hair cell death nor hearing loss after treatment of aminoglycosides.

“We then discovered RIPOR2 regulates the autophagy pathway in hair cells. Knowing this, we developed other laboratory models without the expression of several key autophagy proteins that did not exhibit hair cell death or hearing loss when treated with the antibiotic,” said Jinan Li, Ph.D., a postdoctoral fellow in the Zhao lab and first author of the paper.

The study authors say the proteins identified in this study could potentially be used as drug targets to prevent aminoglycoside-induced hearing loss in future studies.

Sci Tech Daily, 6 October 2022

<https://scitechdaily.com>

The Mediterranean Sea Is So Hot, It's Forming Carbonate Crystals

2022-10-04

IF YOU STAND on the coast of Israel and gaze out across the Mediterranean Sea, you'll spy deep-blue, calm waters that have sustained humans for millennia. Beneath the surface, though, something odd is unfolding: A process called stratification is messing with the way the sea processes carbon dioxide.

Think of this part of the Mediterranean as a cake made of liquid, essentially. Fierce sunlight heats the top layer of water that sits on cooler, deeper layers below. Out in the open ocean, where water temperatures are lower, CO₂ dissolves in saltwater—which is what allows Earth's seas to collectively absorb a quarter of the carbon emissions that humans pump into the atmosphere. But as the eastern Mediterranean Sea heats up in the summer, it can no longer absorb that gas and instead starts releasing it.

Bulletin Board

Gossip

OCT. 21, 2022

It's the same thing that happens in a bottle of soda that is carbonated with carbon dioxide. “You usually keep it cold, so the dissolved gasses will stay dissolved,” says Or Bialik, a geoscientist at the University of Münster in Germany. “If you leave it in your car for a while and try to open it, all the gasses are going to pop out at once, because when it warms, the capacity of the fluid to hold CO₂ goes down.” Boom, fizz, you've got a mess on your hands.

In the Eastern Mediterranean, this dynamic is rather more consequential for the climate than a sticky car interior, as the sea begins burping up great quantities of CO₂ that the water can no longer hold. And Bialik and his colleagues have discovered that these warming, stratifying waters teem with a second carbon problem: The team recently caught aragonite crystals in sediment traps. Aragonite is a form of calcium carbonate, which oceanic creatures like snails use to build their shells. Except in the increasingly hot Eastern Mediterranean, the aragonite is forming abiotically. That's another sign that the water is getting so warm that it's releasing its carbon load.

In these hot, shallow, stable waters, the fluid on top doesn't mix much with the underlying colder layers, in contrast to deeper parts of the ocean, where upwelling brings up cooler H₂O. “The conditions are so extreme that we can definitely generate calcium carbonate chemically from these waters, which was kind of a shock for us,” says Bialik, who coauthored a recent paper describing the discovery in the journal *Scientific Reports*. (He did the research while at the University of Malta and University of Haifa.) “It's basically like a beaker that sits there for a very long time, and it's long enough to get these reactions going and start generating these crystals.”

It's like the experiments you might have done as a kid with sugar crystals. You added a bunch of sugar to water, saturating it. Nothing happened until you dropped in a string, which allowed the sugar to precipitate into fat clusters that clung to the string. Similarly, when the Mediterranean heats up and stratifies, it's saturated with carbonate. How exactly the aragonite reactions get going, Bialik and his colleagues can't yet say, but they may start with nuclei like specks of dust blown off nearby land, upon which the layers of aragonite build into crystals—a very tiny version of the string in the sugar water.

It's also worth noting that the Mediterranean Sea is one of the most microplastic-polluted water bodies in the world: In 2020, scientists reported finding 2 million particles in a single square meter of sediment that was only 5 centimeters thick. Whether aragonite crystals are forming

Bulletin Board

Gossip

OCT. 21, 2022

around microplastics floating in the water column, Bialik doesn't know. "They could probably form around any nucleation center," says Bialik. "I suspect that microplastics may also be a possible one. But as scientists love to say, more research is needed."

What Bialik and his colleagues can say, though, is that as these crystals form, they release CO₂. So much so, Bialik calculates, that they account for perhaps 15 percent of the gas that the Mediterranean Sea emits to the atmosphere.

As the sea warms up and loses its CO₂, both from the water belching it up and from the proliferating crystals, its acidity actually goes down. This is the opposite process from the one that's causing widespread ocean acidification: As humans spew more CO₂ into the atmosphere, the oceans absorb more of it, and the ensuing chemical reaction raises acidity. Acidification makes it harder for organisms like corals and snails (which are known collectively as calcifiers), to build shells or exoskeletons out of calcium carbonate. But as the Mediterranean warms and releases its absorbed carbon back into the atmosphere, it gets more basic, reversing that acidification.

That should be great for the calcifiers, right? Not necessarily. "Many of them have specific temperature ranges in which they can build their shells—not too hot, not too cold," says Bialik. So even if the sea is getting less acidic as it warms, that heat stresses these organisms in a different way. (Not to mention the stress of being constantly exposed to extreme levels of microplastics.)

It's not clear whether aragonite crystals are forming in more places around the world. Scientists are already aware of "whiting events," in which calcium carbonate precipitates in much more obvious ways, turning the waters around the Bahamas and in the Persian Gulf a milky color. In the Eastern Mediterranean, there wasn't an obvious whiting event to clue in Bialik and his colleagues. Instead, they stumbled upon the crystals in their sediment traps.

"This is a somewhat unique area with a variety of conditions that have to happen to make this work," says marine chemist Andrew Dickson of the Scripps Institution of Oceanography, who wasn't involved in the research. "The question then is, to what degree is that environment really special, or is it common around the oceans? And I don't have a clear picture of that in my mind."

Bulletin Board

Gossip

OCT. 21, 2022

It may be that the conditions in the eastern Mediterranean aren't replicated in many other places, so Dickson is leaning toward the idea that this may not be particularly common. But Bialik points out that wherever it may be happening, it could be causing a climate problem: Aragonite crystal formation may mess with the water's ability to absorb atmospheric CO₂, thus interfering with how the ocean reduces levels of the planet-heating gas.

"I won't say we fully understand this yet and fully understand what governs it—when it turns on and when it shuts down," says Bialik. "We didn't even think this process occurs on this scale in open waters, in normal marine conditions. And so we still have a lot that we need to understand about it."

Wired, 4 October 2022

<https://wired.com>

World-first stem cell therapy trial treats spina bifida before birth

2022-10-06

In a world-first clinical trial, three babies have been born after receiving stem cell treatment for spina bifida. The treatment involves administering a stem cell patch to the fetus' spine while still developing in the womb, and early results are promising one year on.

Spina bifida is a birth defect in which the spine fails to develop properly, which can lead to weakness or paralysis of the lower limbs, cognitive issues, and urinary and bowel dysfunction. While there's no cure, post-birth surgery can improve the symptoms in some cases.

But a new clinical trial aims to intervene earlier. Because signs of spina bifida can appear very early on in the pregnancy, there's time to treat it while the fetus is still developing, potentially improving the outcomes. That was the goal of the Cellular Therapy for In Utero Repair of Myelomeningocele (CuRe) trial, conducted at UC Davis Health.

Patients enrolled in the trial undergo surgery midway through pregnancy, where a patch containing mesenchymal stem cells is carefully applied to the affected area of the fetus' spine in utero. Previous studies in sheep and dogs with spina bifida have shown that the technique can prevent paralysis, helping these young animals walk without noticeable disability.

So far, three babies have been born out of the eventual 35 that will be enrolled in the CuRe trial.

Bulletin Board

Gossip

OCT. 21, 2022

So far, three babies have been born out of the eventual 35 that will be enrolled in the CuRe trial. The first received the treatment in July 2021 at 25 and a half weeks gestation, and was born that September. If left untreated, it was expected that the baby would have been born with leg paralysis – and yet, she was seen to be kicking and wiggling her toes right away.

Over a year later and things seem to still be going well, but the team remains cautious about jumping to conclusions. The scientists will monitor the babies until they're six years old, and there's a particular milestone at 30 months of age to check how well they're walking and toilet training.

New Atlas, 6 October 2022

<https://newatlas.com>

Oil-eating microbes excrete the world's cheapest "clean" hydrogen

2022-10-03

Texan company Cemvita is promising clean hydrogen at less than US\$1/kg, after testing a fascinating new technique in the lab and the field. The idea is to pump specially developed microbes into depleted oil wells, where they'll eat oil and excrete hydrogen.

Humans have been harnessing tiny single-celled and multicellular organisms to perform work for much longer than we've known what they were. The earliest beers known to history were brewed some 13,000 years ago, making systematic use of a microscopic fungus called yeast, and its habit of eating sugars and starches and excreting carbon dioxide and ethanol. That's about 7,000 years before recorded history was known to history.

Microbes can be incredibly hard workers – Louis Pasteur once described yeast's work on glucose as the equivalent of a 200-pound person chopping two million pounds of wood in two days. But their ability to party is critical as well; in two days under the right conditions, 100 yeast cells can multiply into 400 billion.

Now that humans are beginning to get a handle on genetic engineering, a huge range of other possibilities are opening up. And with the rise of artificial intelligence, it's becoming easier than ever before for scientists to identify which bits of the genetic code are responsible for a microbe's

Bulletin Board

Gossip

OCT. 21, 2022

desirable behaviors, and repeat those sections to juice these little creatures up for higher and higher performance.

One company engaged in such work is Cemvita, which is concentrating at present on microbes that feast on hydrocarbons – in particular, crude oil – and ferment them, excreting hydrogen and carbon dioxide. Unfortunately, it's not accurate to describe this release as a belch or a fart – believe me, nothing would make me happier, but in this case the gases simply bubble out through the cell walls without any celebratory audio.

This ties in beautifully with the way oil wells work; they start out at maximum production when they're first tapped, sometimes even squirting out of the earth under pressure. But then things gradually dwindle until it costs more in energy to push or pull the remaining oil out than you can sell it for. So there's plenty of oil left in depleted wells, as well as some handy infrastructure in place at each project. Cemvita wants to turn all these wells into biological hydrogen farms.

So, it presumably stops up the top of the well, before pumping a heap of specially bred microbes down into its murky depths in a stream of recycled water. The microbes go to work, feasting, excreting and multiplying, and Cemvita captures the gases as they exit the top of the well, separating them into hydrogen for processing and sale, and carbon dioxide for sequestration. The company is able to send nutrients and inhibitors down into the well to keep things under control and moving in the right direction.

Cemvita started out in the lab, modifying the micro-organisms genetically, but trying not to go far enough to get them classified as genetically modified.

"We are actively engaging with regulatory agencies (such as EPA) regarding the application of genetically engineered microbes," reads the company's website. "In some cases, since we are only enhancing the natural ability of microorganisms (for example by increasing the copy number of genes that already exist), the microbes are not considered genetically-modified. Regulatory assessment is included as a deliverable for our projects."

The team set its sights on the economic target of hydrogen production at less than US\$1/kg, and its oil-munching microbes quickly overshot their performance targets, becoming six and a half times better at their job than Cemvita projected they'd need to be.

Gold Hydrogen is a Novel Source of Carbon Neutral Hydrogen

Bulletin Board

Gossip

OCT. 21, 2022

From there, it was time to try them out in an actual oil well. Cemvita partnered with an oil production company operating in the Permian basin in West Texas, and stuck a small test load of microbes down into a depleted well. The results: hydrogen levels three times higher than the baseline.

“In a very short time frame,” said Zach Broussard, Director of Gold H2 at Cemvita, in a press release, “we moved our microbes from the lab to the field. The hydrogen production in this trial exceeded our expectations. As we continue to use hydrogen producing microbes downhole, we anticipate we can achieve rates that will translate to hydrogen production at \$1/kg or less.”

Thus, an oil company’s stranded asset becomes an extremely low-effort source of hydrogen – and a very, very cheap one. At less than a dollar a kilogram (2.2 lb) – before subsidies – this could represent some of the world’s cheapest H₂. And there’ll be no lack of feedstock; Cemvita points out that in order to meet the Paris climate goals, some 60% of the world’s known oil reserves will need to stay in the ground.

So what are the risks? Well, they’re mainly regulatory. Firstly, the company will need to satisfy regulators that its microbes are safe for use, and won’t cause unintended environmental consequences.

Secondly, you may have noticed Cemvita can’t call its product “green” hydrogen, presumably due to the carbon dioxide that’s released as part of the process. Instead, it’s calling it “gold” hydrogen, and relying on carbon capture and storage to ensure that its hydrogen is “carbon neutral.” This may limit sales as regulations tighten in the long run.

Thirdly, the business model does give us some cause for concern there. Cemvita needs old oil wells to advance its plan, so where it can’t buy these wells outright, it’ll have to license the technology to, or partner with oil companies to put its microbes to work. The oil companies must be thrilled about the idea – there’d be enough dollar signs spinning in their eyeballs from these long-written-off assets to knock their ten-gallon hats off.

But for this to be good news for the planet, we’ll need to trust these oil companies to dutifully capture and permanently store all the carbon dioxide that comes out of their wells. Either that, or we’ll need to trust environmental regulators – in Texas, no less, to begin with – to hold these

Bulletin Board

Gossip

OCT. 21, 2022

oil companies to their promises. I’m not feeling a ton of trust in my heart of hearts, but hey, that’s just me.

New Atlas, 3 October 2022

<https://newatlas.com>

Efficient new catalyst converts mixed plastic waste into propane

2022-10-10

Plastic waste is one of the most pressing environmental problems of our time, and sorting different types makes recycling tricky. Now, engineers at MIT have developed an effective new catalyst that breaks down mixed plastics into propane, which can then be burned as fuel or used to make new plastic.

The ubiquity of plastic in our modern world means that huge amounts of the stuff ends up in the environment, and there are worryingly few places that seem to be untouched by it. Plastic is now found from the north to the south poles, from the seafloor to the top of Mt Everest, and is working its way up the food chain to the point it can now be found inside our own bodies.

Plastics have very strong carbon bonds, which makes them resilient and reliable during use but a real pain to recycle. Worse still, different types of plastic require different recycling methods, making it difficult to sort and recycle at scale. But the MIT team has now proposed a new technique that can deal with multiple plastics mixed together, converting them into a single product, propane, that itself has many uses.

The key is a catalyst that consists of a porous crystal called a zeolite, which is stuffed with cobalt nanoparticles. While other catalysts break carbon bonds in unpredictable places, producing varied end-products, the new catalyst break the bonds in a specific and repeatable location.

That location means it essentially shears off one propane molecule, leaving the rest of the hydrocarbon chain behind, ready to undergo the process over and over. This works on multiple types of plastic, including the most commonly used ones like polyethylene (PET) and polypropylene (PP).

In tests on real-world samples of mixed plastics, the team found that the catalyst and the process converted around 80% of the plastic into propane, without producing methane as a by-product. The resulting propane can

While other catalysts break carbon bonds in unpredictable places, the new catalyst break the bonds in a specific and repeatable location.

Bulletin Board

Gossip

OCT. 21, 2022

be used directly as a relatively low-impact fuel, or as a feedstock to make new plastics in a partially-closed loop system. Importantly, the ingredients for the catalyst – zeolite, cobalt and hydrogen – are relatively cheap and easy to come by.

As intriguing as the study is, the researchers say that future work will need to focus on how the technique might be scaled for use in real-world plastic recycling streams, as well as how it might be affected by contaminants like glues and labels.

The research was published in the journal JACS Au.

New Atlas, 10 October 2022

<https://newatlas.com>

Scientists develop a new printable, wearable insect repellent

2022-10-11

A new type of insect-repellent delivery device has been developed by scientists from the Martin Luther University Halle-Wittenberg (MLU). With the help of a 3D printer, the active ingredient is first “encapsulated” and formed into the desired shape, such as a ring, which can then be worn and releases an agent designed to repel mosquitoes for a long time. The team has presented its work in the International Journal of Pharmaceutics.

The researchers have developed their prototypes using “IR3535,” an insect repellent developed by MERCK. “Mosquito sprays containing IR3535 are very gentle on the skin and have been used all over the world for many years. That’s why we’ve been using the agent for our experiments,” says Professor René Androsch from the MLU. It is usually applied as a spray or lotion and offers several hours of protection. However, Androsch and his team are looking for ways to release the agent over a much longer period, such as by encapsulating it in a wearable ring or bracelet.

The researchers used a special 3D printing technique to insert the insect repellent into a biodegradable polymer in a controlled manner and to shape the mixture of substances in various ways. “The basic idea is that the insect repellent continuously evaporates and forms a barrier for insects,” explains the lead author of the study, Fanfan Du, a doctoral candidate at the MLU.

The rate at which the insect repellent evaporates depends on many different factors, including temperature, concentration and the structure

Bulletin Board

Gossip

OCT. 21, 2022

of the polymer used. After conducting various experiments and simulations, the team predicts that the insect repellent needs well over a week to evaporate completely at a temperature of 37°C (98,6 °F, i.e., body temperature).

While the researchers have proven that it is absolutely possible to develop a wearable insect repellent, the rings and other forms created for the study are only prototypes. According to Androsch, further research needs to be carried out to determine how well the rings function under actual conditions. The encapsulation material could also be further optimized.

Phys Org, 11 October 2022

<https://phys.org>

Early Mars may have been home to methane-producing microbes which caused climate cooling

2022-10-12

Mars may have been home to methane-producing microbial life billions of years ago, according to computer simulations of early Martian geology.

While it has long been suggested that Mars could have supported simple organisms in its younger days, the viability of this hypothesis has never been quantified, say the French researchers who developed the simulations. Until now.

Their research is published in Nature Astronomy.

While the solar system was still quite young, billions of years ago, Mars was being bombarded by a huge number of meteorites and asteroids. There is also evidence to suggest that the Martian surface at least periodically supported liquid water.

This early period in Mars’s geological history is known as the Noachian after the ancient patriarch, Noah. A precise age for the Noachian is unknown, but it probably spanned 4.1 billion to 3.7 billion years ago. It is roughly equivalent, geologically, to Earth’s Hadean 4.6-4 billion years ago.

“During the Noachian, Mars’ crust may have provided a favourable environment for microbial life,” the authors of the recent study write. They add that the top layer of Mars’s surface would have made a good home for early life, sheltering them from ultraviolet and cosmic radiation.

Four billion years ago, Mars was likely wet and warm.

Bulletin Board

Gossip

OCT. 21, 2022

Noachian Mars would have been a suitable habitat for hydrogenotrophic methanogens – simple microbial organisms that consumed hydrogen and carbon dioxide, and produced methane as waste. On Earth, hydrogenic methanogenesis was among the earliest metabolisms to emerge.

The scientists used a state-of-the-art model to see the effect of methanogenic hydrogenotrophy on the early Martian system. They combined a photochemical climate model (looking at the influence of radiation on the chemicals in the Martian atmosphere) and a model of the early Martian crust. They could then analyse atmospheric composition, climate, thermal properties of the crust, and gas exchange between the crust and atmosphere.

“We find that subsurface habitability was very likely, and limited mainly by the extent of surface ice coverage,” the authors write. “Biomass productivity could have been as high as in the early Earth’s ocean.”

“However, the predicted atmospheric composition shift caused by methanogenesis would have triggered a global cooling event, ending potential early warm conditions, compromising surface habitability and forcing the biosphere deep into the Martian crust,” the authors say.

Hydrogenotrophic methanogen effects on Earth’s early climate of were recently analysed. Comparing this study to the modelling of early Mars shows similarities and differences.

“On the one hand, models predict very likely habitability to hydrogenotrophic methanogens on both young planets, with similar biomass production,” the authors write. “On the other hand, climate feedbacks work in opposite directions.”

While on Earth hydrogenotrophic methanogens may have helped maintain temperate conditions, they would have cooled the early Martian surface by 33-45°C. This is because on Earth, the nitrogen-rich atmosphere would have seen increased methane production led to a greenhouse effect. On Mars, however, H₂ actually has a stronger greenhouse effect than the methane that would have been produced by its consumption.

The authors say that the best evidence supporting their model’s predictions would be the discovery on present-day Mars of methanogenic life descended from hypothetical microbes modelled. But, as the Martian atmosphere has thinned in the intervening billions of years, life on Mars would have had to shift its energy source from H₂ to feeding off thermal

Bulletin Board

Gossip

OCT. 21, 2022

energy and chemical reactions like ionisation deeper below the planet’s surface.

But the work could also help inform the search for the fossilised remains of Noachian microbes. That 3 to 4-billion-year-old fossils have been found and analysed on Earth suggests the same may be true on Mars.

For such searches in the future, the authors suggest three sites – Hellas Planitia, Isidis Planitia and Jezero Crater – as the best places to look for signs of early methanogenic life near the surface of Mars.

Handy, then, that the Perseverance rover, tasked with looking for signs of ancient life on Mars, is already making tracks on the Jezero Crater.

Cosmos, 12 October 2022

<https://cosmosmagazine.com>

Scientists Discover a Previously Unknown Plant Mechanism – And Its Impact Could Be Enormous

2022-10-12

Scientists find that meiotic exit in Arabidopsis is driven by P-body-mediated inhibition of translation

A previously unidentified mechanism for reprogramming gene expression during the transition when one cell differentiates into another has been uncovered by Albert Cairó, Karel Riha, and their colleagues. The mechanism occurs at the conclusion of meiosis, a specialized cell division required for sexual reproduction, and allows germ cells and pollen to differentiate.

This mechanism involves the dynamic localization of essential regulatory components into intracellular condensates that resemble liquid droplets. This process is directly tied to seed production and may offer up new avenues for generating more sustainable crops that can withstand harsher environmental conditions. The findings were recently published in the prestigious journal Science.

Cells are not static things; they change from one type to another. The activation of a certain collection of genes influences how cells specialize in completing specific tasks and when they divide or differentiate. Cell biologists like Albert Cairó and Karel Riha use a combination of sophisticated scientific methods to investigate the plant’s micro-world.

The discovery might pave the way for the development of more sustainable crops that can withstand tougher environmental conditions.

Bulletin Board

Gossip

OCT. 21, 2022

Cellular biology is currently undergoing a revolution, with the traditional perspective of cell organization being expanded to new horizons.

“Now we know that the cell not only contains traditional organelles delineated by a membrane but many molecular processes are confined inside less defined membrane-less organelles, also called biomolecular condensates (biocondensates). During the last ten years, the importance of these biocondensates has started being recognized. We now contribute to this field by showing how a specific type of biocondensate forms at the end of meiosis and inhibits protein synthesis,” explains Albert Cairó, the first author of this research.

“This, on the one hand, terminates the meiotic processes, but on the other hand, it marks the beginning of a genetically different generation of cells,” adds Cairó. But this is not all. The research team believes that analogous mechanisms also act in other organisms and cellular settings, including cell differentiation or stress responses.

The discovery of Karel Riha lab members could have an enormous societal impact.

“We live in a state of climate emergency. Even though plants can fight against a huge variety of stresses, including high temperatures and drought, their development and reproduction can be severely impaired. This means that we are at risk of a dramatic reduction in crop yield, just when the yield has to be increased to satisfy human needs. And that’s why plant research should now be one of the priorities,” explains the corresponding author and research group leader Karel Riha.

The lab’s primary mission is to shed light on fundamental biological processes closely linked to plant reproduction and seed formation, which in many crops translates into yield.

“The research findings show that biomolecular condensates play an important role in plant fertility, and their behavior is likely linked to environmental stress. It is therefore obvious that our discovery is the first step into developing new solutions resulting in sustained crop production under harsher conditions,” explains Albert Cairó.

The technical approaches the team had to perform are genuinely admirable, and the publication of this research in *Science* is reassuring that Riha’s lab is going in the right direction.

The path to the discovery

Bulletin Board

Gossip

OCT. 21, 2022

Studying meiosis in the model plant *Arabidopsis thaliana* is particularly challenging. The research team focused on extraordinary and rare cells hidden in 0.1-0.4 mm small floral buds. Moreover, the meiotic division stages that are the study’s focus occur fast – the whole process takes five to six hours. Therefore, they are not easy to capture. The research team must use state-of-the-art technologies and a significant portion of creativity and imagination to investigate this process.

Riha’s team had to establish conditions for live imaging of meiotic division inside the anther (the part of the stamen that contains pollen). The team used advanced microscopy and became one of the two labs in the world that were able to observe plant meiosis live. Another piece of essential expertise the team acquired was the mastery of protoplast technology. Protoplasts are isolated plant cells that have been deprived of their surrounding cell wall, which makes them easy to genetically manipulate and visualize under the microscope. This technology allowed the team to elucidate some problems more quickly and efficiently than using meiotic cells.

Anna Vargova contributed significantly to understanding the newly described complex mechanism. Pavlina Mikulkova provided expertise and lent her magic hand during live cell imaging of meiosis using the Lightsheet microscope. The research team was supported by the CEITEC core facility CELLIM and by the Plant Sciences Core Facility. The research took more than eight years and was financed by the Czech Ministry of Education Youth and Sports grant project REMAP. “It would be extremely difficult to develop such a complex project without the long-term funding we had. In fact, at one point, it felt like our limit was just our imagination, and I believe that this was crucial for our far-reaching discovery,” says Albert Cairó.

Sci Tech Daily, 12 October 2022

<https://scitechdaily.com>

Wildlife populations plunge 69% since 1970: WWF

2022-10-13

Wild populations of monitored animal species have plummeted nearly 70 percent in the last 50 years, according to a landmark assessment released Thursday that highlights “devastating” losses to nature due to human activity.

Bulletin Board

Gossip

OCT. 21, 2022

Featuring data from 32,000 populations of more than 5,000 species of mammals, birds, amphibians, reptiles and fish, the WWF Living Planet Index shows accelerating falls across the globe.

In biodiversity-rich regions such as Latin America and the Caribbean, the figure for animal population loss is as high as 94 percent.

Globally, the report found that monitored animal populations had fallen 69 percent since 1970.

Marco Lambertini, director general of WWF International, said his organization was “extremely worried” by the new data.

“(It shows) a devastating fall in wildlife populations, in particular in tropical regions that are home to some of the most biodiverse landscapes in the world,” he said.

Mark Wright, director of science at WWF, said the figures were “truly frightening”, particularly for Latin America.

“Latin America is renowned for his biodiversity of course, it’s really important for lots of other things as well,” he said.

“It’s super important for regulating the climate. We estimate currently there’s something like 150 to 200 billion metric tons of carbon wrapped up in the forests of the Amazon.”

That is equivalent to 550 to 740 billion tons of CO₂, or 10 to 15 times more than annual greenhouse gas emissions at current rates.

The index found that freshwater species had declined more than those found in any other habitat, with an 83-percent population fall since 1970.

The report found that the main drivers of wildlife loss are habitat degradation due to development and farming, exploitation, the introduction of invasive species, pollution, climate change and disease.

Lambertini said the world needed to rethink its harmful and wasteful agricultural practices before the global food chain collapsed.

“Food systems today are responsible for over 80 percent of deforestation on land, and if you look at the ocean and freshwater they are also driving a collapse of fishery stocks and populations in those habitats,” he said.

With world leaders due to convene in Montreal for the COP15 biodiversity summit in December, the report authors called for an international,

In biodiversity-rich regions such as Latin America and the Caribbean, the figure for animal population loss is as high as 94 percent.

Bulletin Board

Gossip

OCT. 21, 2022

binding commitment to protect nature, similar to the 2015 Paris Agreement on climate change.

‘Need to act now’

The Living Planet Report argues that increasing conservation and restoration efforts, producing and consuming food more sustainably, and rapidly and deeply decarbonising all sectors can alleviate the twin crises of climate change and biodiversity loss.

It also calls for governments to properly factor into policymaking the value of services rendered by nature, such as food, medicine and water supply.

“We need to stress the fact that nature loss is not just a moral issue of our duty to protect the rest of the world. It is actually an issue of material value, an issue of security for humanity as well,” said Lambertini.

Some areas experienced more population loss than others—Europe, for example, saw a wildlife population decline of 18 percent.

“But that also masks historic, very extreme losses of biodiversity,” said Andrew Terry, director of conservation at the Zoological Society of London, which helped compile the data.

“We know that we’re coming out of (a) low point in the state of biodiversity in the northern hemisphere.”

In Africa, where 70 percent of livelihoods rely on nature in some form, the report showed a two-thirds fall in wildlife populations since 1970.

Alice Ruhweza, Africa regional director at WWF, said the assessment showed how there was a “huge human cost” when nature is lost.

She said young people in particular were concerned about wildlife preservation, and would push governments to implement greater protective measures.

“We have a young, entrepreneurial and increasingly educated population that is showing more awareness around issues of nature,” said Ruhweza.

“So the potential for transformative change is really significant. But the time is running short, and we need to act now.”

Phys Org, 13 October 2022

<https://phys.org>

Bulletin Board

Curiosities

OCT. 21, 2022

Sorry to break it to you, but low-sugar booze is still bad for you

2022-10-07

New research presented at this year's International Congress on Obesity (Melbourne, 18–22 October) and to be published in the journal *Alcohol & Alcoholism* shows that women can be misled by the “health halo” effect of alcoholic drinks labeled as low sugar, believing them to be lower in alcohol content, overall energy, and healthier compared with “regular” alcoholic drinks. They are also less likely to state they would make adjustments to their diets and physical activity if they had consumed these low sugar alcoholic drinks. The study is by Dr. Ashleigh Haynes, Cancer Council Victoria, and University of Melbourne, Melbourne, VIC, Australia, and colleagues.

Alcohol is energy dense and alcoholic products are the largest discretionary source of energy in the diets of Australian drinkers (around 16% of daily energy intake, around double the 8% provided by discretionary cakes and muffins). Excess alcohol consumption can increase the risk of weight gain and chronic diseases such as cancer and heart disease. Up to one in five alcohol products in selected categories on the Australian market feature a “low sugar” or other sugar-related claim. The authors say, “Such claims have the potential to create a ‘health halo,’ misleading consumers to perceive products displaying them as healthier than other options, which may increase consumption.”

The authors explain there are currently no published data on calorie differences between low sugar and products with no related claims in Australia, and this would be hard to estimate reliably because there is no mandatory energy labeling for alcohol products and information is voluntarily provided for very few alcohol products. While any sugar content would add to the overall energy content, alcohol as a macronutrient contributes to the energy content of the drink by definition and this is extra “discretionary” energy in the diet that is often not compensated for. The authors say that any claims that alcohol drinks that are lower in sugar and overall calories are healthier/less harmful to health is problematic, since alcohol in any amount is harmful to health in addition to the calories it contributes.

In this study, 501 Australian women aged 18–35 years were recruited from an opt-in online survey panel. Half of the participants viewed images of products with a low sugar or related claim, and half viewed identical products with no claims. Participants did this using six images of ready

Alcohol is energy dense and alcoholic products are the largest discretionary source of energy in the diets of Australian drinkers.

Bulletin Board

Curiosities

OCT. 21, 2022

to drink (RTD) spirit drinks with mixer if they had consumed these in the past 12 months, or cider drinks if they had consumed those in the past 12 months. Where participants had consumed both, they were randomly allocated to one or the other.

Using a numeric rating scale from 1–7 for each outcome, the ratings given by the participant to their six drinks were averaged. The authors found that products with low sugar claims were rated as significantly lower in sugar (by 1.8 points on the 7-point scale) and kilojoules/energy (by 0.9 points), healthier (by 0.3 points), less harmful to health (by 0.3 points) and more suitable for weight management (by 0.5 points) and a healthy diet (by 0.3 points) than identical products with no claim, with all findings statistically significant. Despite participants being informed that all products (with or without the low sugar claim) were of an equivalent alcohol and standard drink content, those with low sugar claims were rated as significantly lower in alcohol (by 0.3 points on the 7-point scale) than products with no claim.

There were no significant differences between conditions in anticipated social approval associated with consuming the products (that is the level to which drinking such a drink would help the participant feel socially accepted), or in hypothetical intentions to consume the products (participants were asked how likely they would be to consume the product and how many servings they would consume in the next two weeks if it was available to them).

Participants who viewed low sugar claims were significantly less likely to intend to compensate for calories in these low sugar products by modifying their food intake or physical activity. The authors established this by asking, “If you drank this product next time you were drinking alcohol, how likely are you to... (a) ...Eat less than usual in one or more meals to make up for the kilojoules/calories in this drink? (b) ...Exercise more than usual to make up for the calories in this drink (c)...Eat low calorie, low fat, or low sugar foods in one or more meals to make up for the calories in this drink?” Looked at another way, those participants who viewed the no claim drinks were more likely to state that they would adjust their diet and activity habits to account for calories consumed in “regular” alcoholic drinks.

The authors say, “Low sugar and related claims on alcohol products generate a ‘health halo,’ whereby consumers generalize from a specific favorable attribute (low sugar) to other attributes (lower in calories, alcohol) and global appraisals of the product (healthier, less harmful,

Bulletin Board

Curiosities

OCT. 21, 2022

better for weight management). These claims also have the potential to impact diet and activity behaviors following consumption.”

They conclude, “Our findings demonstrate that low sugar claims on alcohol products can be misleading and support policy options to prohibit such claims on alcohol products and/or counter their effects, for example via health warning labels and/or mandatory energy labeling.”

Alcohol product labeling in Australia is currently under review by the regulator, Food Standards Australia New Zealand (FSANZ). Other jurisdictions such as the U.K. are considering such labeling as part of their national obesity strategy.

Jane Martin, President of the Australian & New Zealand Obesity Society and Executive Manager of the Obesity Policy Coalition commented, “These low or no sugar alcohol products are the latest fad pushed by the industry to hook young people. Alcohol companies shouldn’t be allowed to use promotional claims that imply these harmful products are better for consumers.

“With FSANZ currently reviewing alcohol labeling, this is a critical opportunity to enact positive changes that benefit everyone. Higher standards must be implemented to stop promotional sugar claims on alcohol products and introduce mandatory energy labeling. Consumers need clear, honest labeling to allow them to evaluate alcohol products and make informed purchases without being influenced by marketing claims.”

Medical Xpress, 7 October 2022

<https://medicalxpress.com>

Eureka! Finally, the Real Answer Why Your Best Ideas Come in the Shower

2022-10-09

Being in the shower when a great idea strikes or a solution to a nagging problem springs to mind is a classical situation many can identify with. You’re showering. Your mind wanders. Then, all of the sudden, eureka! A new insight or creative breakthrough occurs out of the blue.

Why a wandering mind sometimes comes up with creative solutions to a problem when a person is engaged in a “mindless” task is explained by Zac Irving, a University of Virginia assistant professor of philosophy, in new co-written research.

Bulletin Board

Curiosities

OCT. 21, 2022

The secret seems to be that the task at hand isn’t truly mindless. A moderate level of engagement is actually required.

Written with University of Minnesota psychology professor Caitlin Mills and others, the “shower effect” paper was recently published in the journal *Psychology of Aesthetics, Creativity, and the Arts*.

“Say you’re stuck on a problem,” Irving said. “What do you do? Probably not something mind-numbingly boring like watching paint dry. Instead, you do something to occupy yourself, like going for a walk, gardening, or taking a shower. All these activities are moderately engaging.”

The new study affirms this anecdotal evidence, elevating Irving’s experimental model for the effect.

So what’s the proof? Don’t let your mind wander. This takes a little setting up.

Wandering in the Wrong Direction

Research published a decade ago in the journal *Psychological Science* seemed to confirm what many people suspected. When we perform an “undemanding” task, our brains tend to wander; and when our brains wander, creativity tends to flow.

“There was this research in 2012, ‘Inspired By Distraction’ by Benjamin Baird and colleagues, that really blew up, both in terms of in science and in media and in the popular imagination, which was mind-wandering seems to benefit creativity and creative incubation,” Irving said.

In that research, scientists asked participants to come up with creative alternate uses for everyday items – a brick, for example – following an “incubation period” that involved tasks of various levels of mental demand. According to the findings, the lower the mental demand, the higher the participants scored on the creativity test.

“Compared with engaging in a demanding task, rest, or no break,” the study’s authors wrote, “engaging in an undemanding task during an incubation period led to substantial improvements in performance on previously encountered problems.”

However, follow-up studies yielded inconsistent results. Some research appeared to find a link between mind-wandering and creativity, including among physicists and writers. Yet other studies failed to replicate the original finding that received so much press. Irving has a theory as to why.

Bulletin Board

Curiosities

OCT. 21, 2022

“They weren’t really measuring mind-wandering,” he said. “They were measuring how distracted the participants were.”

Irving said another issue with the study, and others like it, is the variety of lab-friendly tasks participants are asked to perform. They may tax the mind, but they don’t translate well to the real world.

“The typical task that you use in mind-wandering research is called a Sustained Attention Response Test,” he said. “And what that test involves is, for example, seeing a stream of digits, 1 through 9, and not clicking when you see a ‘3.’ That’s the typical mind-wandering study. They’re just not like anything in people’s daily lives.”

That’s important because the shower effect likely depends on the context you’re in.

“Mind-wandering might help in some contexts, like taking a walk, but not others, like a dull psych task,” Irving said of his theory.

Brainstorming Under a New Design

To test this theory, Irving and Mills, along with their research associates, asked study participants at the University of New Hampshire to come up with alternate uses for either a brick or a paperclip. Then the researchers split participants into two groups to watch different three-minute videos that would serve as the incubation models for the participants’ new creative ideas.

One group watched a “boring” video: two men folding laundry.

Another group watched a “moderately engaging” video. They saw a cheeky scene from the classic 1989 film “When Harry Met Sally,” in which Meg Ryan’s character demonstrates – while seated at a crowded restaurant – how to convincingly fake an orgasm.

“What we really wanted to know was not which video is helping you be more creative,” Irving said. “The question was how is mind-wandering related to creativity during boring and engaging tasks?”

He added, “The reason we used a video is because Caitlin is very much engaged in this movement within psychology to use naturalistic tasks” – meaning things people might do in real life.

Following the videos, participants were asked to quickly jump back into the process of listing alternate uses for the hypothetical brick or paperclip

Bulletin Board

Curiosities

OCT. 21, 2022

they were issued previously, working from ideas formed while watching the videos.

Participants also reported how much their minds wandered – that is, moved freely from topic to topic – during the videos.

What the researchers discovered is that mind-wandering helps, but only sometimes. Specifically, mind-wandering led to a greater number of ideas, but only when participants were watching the “engaging” video rather than the “boring” one.

During the engaging video, in other words, there was a positive correlation between the amount of mind wandering and the creative ideas generated. Mind-wandering made participants more creative.

The results form the basis for a model that can now be used on other types of real tasks to demonstrate how they might invite greater creative inspiration.

While the researchers may never study showering per se, for obvious reasons, they said they intend to continue to scale up from video watching. For example, one of their future projects will use virtual reality to study mind-wandering in realistic contexts, such as walking down a city street.

Sci Tech Daily, 9 October 2022

<https://scitechdaily.com>

Evolution in action as frogs in Chernobyl exclusion zone turn black

2022-10-03

Evolution is the result of environmental pressures forcing species to adapt, and few environments exert pressures like the Chernobyl exclusion zone. A new study has revealed evolution in action as frogs within the radioactive region seem to be turning blacker than those outside the zone.

The explosion at the Chernobyl Nuclear Power Plant in 1986 released a huge amount of radioactive material into the environment and it is now at the center of an exclusion zone encompassing 1,000 sq miles (2,600 sq km). If there’s a silver lining to be found from one of the worst catastrophes humans have ever unleashed on the world, it’s that the area has become a nature reserve that houses a range of species.

Evolution is the result of environmental pressures forcing species to adapt, and few environments exert pressures like the Chernobyl exclusion zone.

Bulletin Board

Curiosities

OCT. 21, 2022

This unique environment offers scientists an unprecedented glimpse into a microcosm of nature – in this case, evolution. How might animals within the exclusion zone be adapting to the higher levels of radiation in their environment?

In 2016, the team on the new study found a few Eastern tree frogs in the Chernobyl exclusion zone that were black, rather than their usual bright green color. The researchers wondered if this was the result of natural selection from the higher radiation in the area.

To investigate, the team returned for follow-up studies over the next few years, collecting more than 200 eastern tree frogs from 12 ponds with different levels of radioactive contamination, including four sites outside the zone for comparison's sake.

And sure enough, they found that the closer the frogs lived to areas with high radiation levels, the darker they were. Those individuals living within the exclusion zone were on average 43.6% darker than those outside, with some of them almost pitch black.

Why would this environment turn frogs black? The team says that melanin, the pigment that darkens the skin of animals, works to reduce cell damage caused by radiation. Normally that's ultraviolet radiation from the Sun, but it's also been shown to protect against ionizing radiation like that present at Chernobyl. This means that individuals with darker skin will be less likely to experience cell damage after radiation exposure.

The team hypothesizes that at the time of the accident, frogs in the area that happened to be darker suddenly had an advantage in the new extremes of this environment, meaning they were more likely to survive and reproduce. After three and a half decades and more than 10 generations of frogs, dark skin is now the norm in the exclusion zone.

It's a fascinating little case study into evolution, and further work could help scientists better understand the impacts of nuclear disasters and how ecosystems can recover.

The research was published in the journal *Evolutionary Applications*.

New Atlas, 3 October 2022

<https://newatlas.com>

Bulletin Board

Curiosities

OCT. 21, 2022

Artificial Superstrong Silkworm Silk Is 70% Stronger Than Spider Silk

2022-10-07

Although spiders hold the market for the strongest silks, they are too aggressive and territorial to be farmed. Incorporating spider DNA into silkworms is the next best alternative, but it is an expensive and difficult-to-scale process. Now, scientists have discovered how the silk naturally produced by silkworms can be made 70% stronger than spider silks by removing a sticky outer layer and manually spinning the silk. The study, by researchers at Tianjin University, was published on October 6 in the journal *Matter*.

"Our finding reverses the previous perception that silkworm silk cannot compete with spider silks on mechanical performance," says senior author Zhi Lin, a biochemist at Tianjin University.

Historically, silkworm silk was used in fashion as a source of luxury robes and apparel fitting for royalty. However, today, silk-based materials are more likely to be found in biomedicine as a material for stitches and surgical mesh. It's also used for tissue regeneration experiments due to its biocompatibility, mechanical properties, and biodegradability.

The most common way to produce silk is by farming silkworms. However, these silks are not as durable or as strong as silk spun by spiders, specifically spider dragline silks which naturally do well under high tension. "Dragline silk is the main structural silk of a spider web. It is also used as a lifeline for a spider to fall from trees," says Lin. Silkworms, on the other hand, use their softer silks for the construction of their cotton-ball-like cocoons during transformation into their moth forms.

While other scientists have combined DNA from spiders to make silk, Lin's research group wanted to use common silkworms, which are more accessible and easily managed. They were inspired by the artificial spinning of spider eggcase silk. This is a close relative to silkworm silk and has been shown to do well in the spinning process.

Natural silkworm silk fiber is composed of a core fiber wrapped by silk glue, which interferes with the spinning of the fibers for commercial purposes. To work around this issue, the scientists boiled silk from the common silkworm *Bombyx mori* in a bath of chemicals that could dissolve this glue while minimizing the degradation of silk proteins. Then, to enhance the silk for spinning, the research team solidified the silk in a bath of metals and sugars.

Spider silk is strong, but it is hard to farm. New research reveals how silk naturally produced by silkworms can be made 70% stronger than spider silks.

Bulletin Board

Curiosities

OCT. 21, 2022

“Since silkworm silk is very structurally similar to eggcase spider silk, which has previously been demonstrated to do well in a mix of zinc and iron baths, we thought to test this alternative method to avoid hazardous conditions used elsewhere,” says Lin. “Sucrose, a form of sugar, may increase the density and viscosity of the coagulation bath, which consequently affects the formation of the fibers.”

Once manually spun and drawn, the silks are thinner than the original silkworm silk, reaching nearly the same size as spider silks. Upon observation under a microscope, Lin describes them as “smooth and strong,” indicating that the artificial fibers could withstand force.

“We hope that this work opens up a promising way to produce profitable high-performance artificial silks,” Lin says.

Sci Tech Daily, 7 October 2022

<https://scitechdaily.com>

First step for Australian biologists as study begins to grow durable and sustainable plants in space

2022-10-09

Australian scientists have begun working with a space start-up on a plan to grow plants on the Moon in less than four years.

The researchers say it could be the first step towards growing plants for food, medicine and oxygen on the lunar surface, and help enable human life on the Moon.

Scientists from the Queensland University of Technology, RMIT University, the Australian National University and Israel’s Ben Gurion University are working with Australian company Lunaria One on the project, known as ALEPH.

They will choose the plant species they work with carefully, based on how quickly they germinate and how well they tolerate extreme temperature swings.

Lunaria One director Lauren Fell said the goal was to put a shoebox-sized, hermetically sealed chamber, or “lunarium”, full of plants and seeds, on an international spacecraft to the Moon.

However, before the plants get to their final destination, they have to survive the gruelling journey into space.

Plants and seedlings will be held in hermetically-sealed chambers, or “lunariums”, and be sent to the Moon.

Bulletin Board

Curiosities

OCT. 21, 2022

“We have to find species that will be able to tolerate a wide range of temperatures that can go from freezing to maybe up to 40 or 50 degrees centigrade,” she said.

“And then once they get to the Moon and have survived that ... be able to grow within some other temperature and difficult conditions.

“There’s radiation that happens up there without an atmosphere to protect it and the difference in gravity — we still have a lot to learn about how that will affect plants.”

Resilient native

One plant in the running to be sent in the lunarium is an Australian native resurrection grass known scientifically as *Tripogon loliiformis*.

Caitlin Byrt, an ANU plant biologist and Lunaria One science lead, believes the native grass is able to endure harsh conditions and survive in a dormant state for months without any water.

“They can stay in that stasis mode for quite a period of time and then, upon re-watering, return to blooming,” she said.

“Space is an exceptional testing ground for how to propagate plants in the most extreme of environments.”

Dr Byrt also compared the conditions for which the plants were being prepared with future challenges to food security on Earth due to the changing climate.

“The extreme conditions that Earth is facing due to climate change present challenges for how we manage food security in the future,” she said.

“If you can create a system for growing plants on the Moon, then you can create a system for growing food in some of the most challenging environments on Earth.

“You want to have the type of resources that can enable you to rapidly, regardless of the conditions, provide food for those in need.”

The first step

Project organisers are planning to have the seeds transported on board a private mission to the Moon run by Israeli organisation Spacell, in a chamber containing sensors, a camera and water.

Bulletin Board

Curiosities

OCT. 21, 2022

After landing on the Moon, researchers say the health of the plants will be monitored for 72 hours, and data will be beamed back to Earth to allow citizen scientists and school children to conduct their own experiments.

“The key to this mission is to get humans involved and to give them a say in how we get there,” Ms Fell said.

“The ALEPH project aims to open up the science and engineering behind growing life on the Moon so that anyone can be involved.

“When we do eventually start to colonise the Moon, Mars and beyond, we will need to grow plants for eating but also for wellbeing.

“This is just the first step to see how we can achieve that.”

ABC News, 9 October 2022

<https://abc.net.au>

The Amazon Rainforest Is in Bigger Danger Than We Thought

2022-10-11

A new network analysis simulates the cascading impacts of rising droughts on South American ecosystems.

In the Amazon rainforest, for every three trees that die due to drought, a fourth tree dies as well, even if it is not directly impacted. In simplified terms, that’s what recent research published in the journal Proceedings of the National Academy of Sciences discovered.

The Potsdam Institute of Climate Action Research team, led by Nico Wunderling, employed network analysis to understand the complicated workings of one of Earth’s most valuable and biodiverse carbon sinks. The areas most vulnerable to transformation to savannah are on the forest’s southern outskirts, where continuous clearance for pasture or soy has already weakened the forest’s resilience for years.

Ripple effect

As climate change causes increasingly frequent and severe dry periods in the Amazon Basin, the rainforest in South America may lose its rain and, with it, its moisture supply. The forest is threatened by a lack of rain because it breathes water: when it rains, the soil absorbs as much as the plants, and both release a large quantity back via evaporation and transpiration. The forest creates most of its own weather through this

Bulletin Board

Curiosities

OCT. 21, 2022

atmospheric moisture recycling, generating up to half of the rainfall in the Amazon Basin. And, although it is incredibly effective, the moisture recycling system ultimately depends on how much water is initially put into the system.

The research team has discovered that even if a dry spell just impacts one particular section of the forest, the damage it causes extends beyond that region by a factor of one to three. Because a lack of rain reduces the amount of water recycled, there will be less rainfall in neighboring areas, placing even more sections of the forest under serious stress.

“More intensive droughts put parts of the Amazon rainforest at risk of drying off and dying. Subsequently, due to the network effect, less forest cover leads to less water in the system overall, and hence disproportionately more harm,” Wunderling explains. “And while we’ve investigated the impact of drought, that rule also holds for deforestation. It means essentially, when you chop down one acre of forest, what you actually are destroying is 1.3 acres.”

A new climate normal

Climate science predicts that what used to be extraordinarily dry years, like 2005 and 2010, may well become the new normal from 2050 onwards, with centennial droughts occurring in up to nine out of ten years by 2060. “These recurrent droughts are already producing quantifiable changes to the Amazon’s moisture network,” explains Henrique Barbosa, co-senior author of the study and assistant professor of physics at the University of Maryland, Baltimore County. “We use these observations to understand and model the consequences of a future climate that resembles a permanent drought state.”

But droughts have different effects on forest systems within the Amazon. “In the Amazon, trees and forest systems are differently adapted to water availability, as some regions commonly exhibit a distinct dry season while others have rain all year round. We specifically acknowledge these local adaptations as they can be a blessing or a curse under climate change,” adds Boris Sakschewski, a co-author of the study at the Potsdam Institute.

“So we find that even the dry season-adapted parts of the Amazon forest won’t necessarily survive a new climate normal, and the risk of tipping into savannah or no trees at all is high,” Sakschewski adds. “The consequences for biodiversity would be disastrous, but the same goes for the local, regional, and global climate.”

Bulletin Board

Curiosities

OCT. 21, 2022

Still much to do

“Yet not all is lost,” says Ricarda Winkelmann, co-senior author of the study and leader of tipping elements research at the Potsdam Institute. “That is because a good part of the forest is still in relatively stable conditions. The network effects of dry spells are likely limited to certain areas in the forest’s southeast and southwest—which happen to be those areas where the forest has been suffering from the human hand already, in clearing forest for pasture or soy.”

“There is still a lot we can do to try and stabilize the Amazon, as preserving it and its ecological services is of utmost importance for local, regional and global climate stability,” Winkelmann says. “And we know how we can do that: by protecting the rainforest from logging, and by rapidly reducing greenhouse gas emissions to limit further global warming.”

Sci Tech Daily, 11 October 2022

<https://scitechdaily.com>

New Discoveries Could Reveal the Nature of Dark Matter

2022-10-11

Earlier this year, a machine learning algorithm detected up to 5,000 possible gravitational lenses, which could transform our ability to chart the evolution of galaxies since the Big Bang.

Kim-Vy Tran of ASTRO 3D and the University of New South Wales (UNSW) and colleagues have now evaluated 77 of the lenses using the Keck Observatory in Hawaii and the Very Large Telescope in Chile. Her international team verified that 68 of the 77 are strong gravitational lenses spanning immense cosmic distances.

This 88% success rate shows that the algorithm is reliable and that we could have thousands of new gravitational lenses. Gravitational lenses have been difficult to discover, and only around one hundred are regularly used.

Kim-Vy Tran’s study, which was recently published in the *Astronomical Journal*, provides spectroscopic evidence of strong gravitational lenses previously found using Convolutional Neural Networks, which were developed by data scientist Dr. Colin Jacobs at ASTRO 3D and Swinburne University.

Bulletin Board

Curiosities

OCT. 21, 2022

The work is part of the ASTRO 3D Galaxy Evolution with Lenses (AGEL) survey.

“Our spectroscopy allowed us to map a 3D picture of the gravitational lenses to show they are genuine and not merely chance superposition,” says corresponding author Dr. Tran from the ARC Centre of Excellence for All Sky Astrophysics in 3-Dimensions (ASTRO3D) and the University of NSW (UNSW).

“Our goal with AGEL is to spectroscopically confirm around 100 strong gravitational lenses that can be observed from both the Northern and Southern hemispheres throughout the year,” she says.

The paper is the result of a collaboration spanning the globe with researchers from Australia, the United States, the United Kingdom, and Chile. The work was made possible by the development of the algorithm to look for certain digital signatures.

“With that, we could identify many thousands of lenses compared to just a few handfuls,” says Dr. Tran.

Gravitational lensing was first identified as a phenomenon by Einstein who predicted that light bends around massive objects in space in the same way that light bends going through a lens. In doing so, it greatly magnifies images of galaxies that we would not otherwise be able to see. While it has been used by astronomers to observe far-away galaxies for a long time, finding these cosmic magnifying glasses in the first place has been hit-and-miss.

“These lenses are very small so if you have fuzzy images, you’re not going to really be able to detect them,” says Dr. Tran.

While these lenses let us see objects that are millions of light years away more clearly, they should also let us “see” invisible dark matter that makes up most of the Universe.

“We know that most of the mass is dark,” says Dr. Tran. “We know that mass is bending light and so if we can measure how much light is bent, we can then infer how much mass must be there.”

Having many more gravitational lenses at various distances will also give us a more complete image of the timeline going back almost to the Big Bang.

Bulletin Board

Curiosities

OCT. 21, 2022

“The more magnifying glasses you have, the better chance you can try to survey these more distant objects. Hopefully, we can better measure the demographics of very young galaxies,” says Dr. Tran.

“Then somewhere between those really early first galaxies and us, there’s a whole lot of evolution that’s happening, with tiny star-forming regions that convert pristine gas into the first stars to the sun, the Milky Way. And so with these lenses at different distances, we can look at different points in the cosmic timeline to track essentially how things change over time, between the very first galaxies and now.”

Dr. Tran’s team spanned the globe, with each group providing different expertise.

“Being able to collaborate with people, at different universities, has been so crucial, both for setting the project up in the first place, and now continuing with all of the follow-up observations,” she says.

Professor Stuart Wyithe of the University of Melbourne and Director of the ARC Centre of Excellence for All Sky Astrophysics in 3 Dimensions (Astro 3D) says each gravitational lens is unique and tells us something new.

“Apart from being beautiful objects, gravitational lenses provide a window to studying how mass is distributed in very distant galaxies that are not observable via other techniques. By introducing ways to use these new large data sets of the sky to search for many new gravitational lenses, the team opens up the opportunity to see how galaxies get their mass,” he says.

Professor Karl Glazebrook of Swinburne University, and Dr. Tran’s Co-Science Lead on the paper, paid tribute to the work that had gone before.

“This algorithm was pioneered by Dr. Colin Jacobs at Swinburne. He sifted through tens of millions of galaxy images to prune the sample down to 5,000. Never did we dream that the success rate would be so high,” he says.

“Now we are getting images of these lenses with the Hubble Space Telescope, they range from jaw-droppingly beautiful to extremely strange images that will take us considerable effort to figure out.”

Associate Professor Tucker Jones of UC Davis, another co-science lead on the paper, described the new sample as “a giant step forward in learning how galaxies form over the history of the Universe”.

“Normally these early galaxies look like small fuzzy blobs, but the lensing magnification allows us to see their structure with much better resolution.

Bulletin Board

Curiosities

OCT. 21, 2022

They are ideal targets for our most powerful telescopes to give us the best possible view of the early universe,” he says.

“Thanks to the lensing effect we can learn what these primitive galaxies look like, what they are made of, and how they interact with their surroundings.”

Sci Tech Daily, 11 October 2022

<https://sci>

Neurons in a dish learn to play Pong — what’s next?

2022-10-12

Hundreds of thousands of human neurons growing in a dish coated with electrodes have been taught to play a version of the classic computer game Pong¹.

In doing so, the cells join a growing pantheon of Pong players, including pigs taught to manipulate joysticks with their snouts² and monkeys wired to control the game with their minds. (Google’s DeepMind artificial intelligence (AI) algorithms mastered Pong many years ago³ and have moved on to more-sophisticated computer games such as StarCraft II⁴.)

The gamer cells respond not to visual cues on a screen but to electrical signals from the electrodes in the dish. These electrodes both stimulate the cells and record changes in neuronal activity. Researchers then converted the stimulation signals and the cellular responses into a visual depiction of the game. The results are reported today in *Neuron*.

Intelligence in a dish

The work is a proof of principle that neurons in a dish can learn and exhibit basic signs of intelligence, says lead author Brett Kagan, chief scientific officer at Cortical Labs in Melbourne, Australia. “In current textbooks, neurons are thought of predominantly in terms of their implications for human or animal biology,” he says. “They’re not thought about as an information processor, but a neuron is this amazing system that can process information in real time with very low power consumption.”

Although the company calls its system DishBrain, the neurons are a far cry from an actual brain, Kagan says, and show no signs of consciousness. The definition of intelligence is also hotly debated; Kagan defines it as the ability to collate information and apply it in an adaptive behaviour in a given environment.

Cellular version of computer game challenges assumptions about intelligence.

Bulletin Board

Curiosities

OCT. 21, 2022

Cortical Labs' work follows on work by neuroengineer Steve Potter, now at the Georgia Institute of Technology in Atlanta, and his colleagues. In 2008, the team reported that neurons cultured from rats can exhibit learning and goal-directed behaviour^{5,6}.

The work from Cortical Labs brings more-sophisticated technology and analytical tools to bear, says Potter. His original dishes had dozens of electrodes; each DishBrain has thousands. Potter's group studied only rodent cells, but the DishBrain team also tested neurons derived from human cells.

The researchers used their system to teach the neurons to respond to an electrical signal that is a substitute for the ball in Pong. In the game, a player slides a vertical paddle up and down the screen to intercept a bouncing ball. In the experiment, the neurons controlled the paddle.

The authors represented the route of the ball by stimulating neurons along the ball's path relative to the paddle. Responses from neurons in another region of the network were used to move the paddle up or down.

To teach the neurons to hit the ball, Kagan says, he and his team harnessed the theory that neurons tend to repeat activity that yields a predictable environment. When the neurons responded in a way that corresponded with hitting the ball, they were stimulated in a location and at a frequency that was the same each time. If they missed the ball, the network was stimulated by the electrodes in random locations and at different frequencies. Over time, the neurons learnt to hit the ball to receive the patterned response rather than the random one.

Not just a game

The work is an important step towards developing assays that could be used, for example, to test the potential effect of a new drug on neuronal function, says neuroscientist Takuya Isomura at the RIKEN Center for Brain Science in Saitama, Japan. But, he adds, it is not yet clear whether the neurons were behaving as they did to create a predictable environment, or in response to some other aspect of the signals they received. "I think the important next step is a detailed explanation of what kind of stimuli can actually make that difference," he says.

Cortical Labs also aims to eventually use neurons to develop "biological processing units" for use in computing. And the techniques developed for DishBrain are quantitative enough that they could be used to compare

Bulletin Board

Curiosities

OCT. 21, 2022

variations in learning between different animals, or between cells from multiple regions of the brain, says Potter.

In the meantime, he says, the decision to embody DishBrain activity as the game Pong was a masterstroke. "People interested in AI are very keen on anything that can play Pong," Potter says. "That was a brilliant decision."

Nature, 12 October 2022

<https://nature.com>

'Smart plastic' material is step forward toward soft, flexible robotics and electronics

2022-10-13

Inspired by living things from trees to shellfish, researchers at The University of Texas at Austin set out to create a plastic much like many life forms that are hard and rigid in some places and soft and stretchy in others. Their success—a first, using only light and a catalyst to change properties such as hardness and elasticity in molecules of the same type—has brought about a new material that is 10 times as tough as natural rubber and could lead to more flexible electronics and robotics.

The findings are published today in the journal *Science*.

"This is the first material of its type," said Zachariah Page, assistant professor of chemistry and corresponding author on the paper. "The ability to control crystallization, and therefore the physical properties of the material, with the application of light is potentially transformative for wearable electronics or actuators in soft robotics."

Scientists have long sought to mimic the properties of living structures, like skin and muscle, with synthetic materials. In living organisms, structures often combine attributes such as strength and flexibility with ease. When using a mix of different synthetic materials to mimic these attributes, materials often fail, coming apart and ripping at the junctures between different materials.

Oftentimes, when bringing materials together, particularly if they have very different mechanical properties, they want to come apart," Page said. Page and his team were able to control and change the structure of a plastic-like material, using light to alter how firm or stretchy the material would be.

The team envisions the material could be used as a flexible foundation to anchor electronic components in medical devices or wearable tech.

Bulletin Board

Curiosities

OCT. 21, 2022

Chemists started with a monomer, a small molecule that binds with others like it to form the building blocks for larger structures called polymers that were similar to the polymer found in the most commonly used plastic. After testing a dozen catalysts, they found one that, when added to their monomer and shown visible light, resulted in a semicrystalline polymer similar to those found in existing synthetic rubber. A harder and more rigid material was formed in the areas the light touched, while the unlit areas retained their soft, stretchy properties.

Because the substance is made of one material with different properties, it was stronger and could be stretched farther than most mixed materials.

The reaction takes place at room temperature, the monomer and catalyst are commercially available, and researchers used inexpensive blue LEDs as the light source in the experiment. The reaction also takes less than an hour and minimizes use of any hazardous waste, which makes the process rapid, inexpensive, energy efficient and environmentally benign.

The researchers will next seek to develop more objects with the material to continue to test its usability.

“We are looking forward to exploring methods of applying this chemistry towards making 3D objects containing both hard and soft components,” said first author Adrian Rylski, a doctoral student at UT Austin.

The team envisions the material could be used as a flexible foundation to anchor electronic components in medical devices or wearable tech. In robotics, strong and flexible materials are desirable to improve movement and durability.

Phys Org, 13 October 2022

<https://phys.org>

Astronomers can't explain a black hole "burp" years after it ate a star

2022-10-11

Black holes have been seen to chow down on stars that wander too close, resulting in a bright stellar show. But now a black hole has been seen doing something nobody's ever seen before – it “burped up” material several years after eating a star, leaving astronomers baffled.

Black holes are famously ravenous objects, swallowing up everything that gets too close, including light itself. When stars are on the menu, the

Bulletin Board

Curiosities

OCT. 21, 2022

intense gravitational forces stretch the material out into long strands in an event known as “spaghettification” or more officially, a tidal disruption event (TDE). This produces clear signals of light, radio and other waves that astronomers can detect as bursts that last a few weeks or months.

In October 2018, astronomers detected and studied a TDE known as AT2018hyz. It seemed to be pretty average for this kind of event – a star just one-tenth the mass of the Sun was being swallowed by a black hole about 665 million light-years away. The light show faded over a few months, and astronomers didn't really give it much thought after that.

That is until June 2021, when the black hole suddenly fired back up with radio signals. This emission appears to be an outflow, the result of material thrown back into space as the black hole shredded the star – but this usually shows up within days or weeks of the initial event, not years later.

“This caught us completely by surprise – no one has ever seen anything like this before,” said Yvette Cendes, lead author of the study. “It's as if this black hole has started abruptly burping out a bunch of material from the star it ate years ago.”

These burps have a lot of power behind them, too. The team calculated that they're traveling at around half the speed of light, which is about five times faster than most TDE outflows.

So far the astronomers can't explain why it took so long for these radio signals to show up. But studying the feeding habits of black holes has revealed some unexpected anomalies in the past – one was seen to be slowly snacking on a star over 10 years, while another would slurp a layer off each time the star swung past, producing flashes that repeat like clockwork. More detailed observations of these events could help unravel how regular they may be occurring.

“This is the first time that we have witnessed such a long delay between the feeding and the outflow,” said Edo Berger, co-author of the study. “The next step is to explore whether this actually happens more regularly and we have simply not been looking at TDEs late enough in their evolution.”

The research was published in *The Astrophysical Journal*.

New Atlas, 11 October 2022

<https://newatlas.com>

Black holes are famously ravenous objects, swallowing up everything that gets too close, including light itself.

Bulletin Board

Technical Notes

OCT. 21, 2022

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

CHEMICAL EFFECTS

[10-year time course of Hg and organic compounds in Augusta Bay: Bioavailability and biological effects in marine organisms](#)

[Effects of organic chemicals from diesel exhaust particles on adipocytes differentiated from human mesenchymal stem cells](#)

[Lead Exposure Induced Neural Stem Cells Death via Notch Signaling Pathway and Gut-Brain Axis](#)

ENVIRONMENTAL RESEARCH

[Toenail zinc as a biomarker: Relationship with sources of environmental exposure and with genetic variability in MCC-Spain study](#)

[Systematic Review and Meta-Analysis of Mercury Exposure among Populations and Environments in Contact with Electronic Waste](#)

PHARMACEUTICAL/TOXICOLOGY

[Hematological indices as indicators of inflammation induced by exposure to pesticides](#)

[Pharmacokinetics of transdermal methyl-, ethyl-, and propylparaben in humans following single dermal administration](#)

OCCUPATIONAL

[Learning from healthcare workers' experiences with personal protective equipment during the COVID-19 pandemic in Aotearoa/New Zealand: a thematic analysis and framework for future practice](#)

[Occupational health effect of TCE exposure: Experiment evidence of gene-environment interaction in hypersensitivity reaction](#)

[Gestational exposure to organophosphate esters and infant anthropometric measures in the first 4 weeks after birth](#)