

Bulletin Board

Contents

JUL. 21, 2023

(click on page numbers for links)

REGULATORY UPDATE

ASIA PACIFIC

Agricultural chemical products and approved labels	4
Australia's annual plastic consumption produces emissions equivalent to 5.7m cars, analysis shows.....	5
Veterinary chemical products and approved labels.....	6
Approved active constituents.....	7

AMERICA

ACC Submits Comments on EPA's HON Proposal	8
Fluorinated carbons, PFAS, found in nearly half of US tap water.....	10
The Editorial Board: It's time to keep a watchful eye on PFAS and consider further regulation	10

EUROPE

Hormones All Over The Place? Endocrine Disruptors Could Be To Blame ..	12
End-of-life vehicles: EU must balance conflicting waste, product, and chemical objectives	13

INTERNATIONAL

Compostable Plastic Is Garbage	14
Overly Broad PFAS Restrictions Could Endanger Healthcare Quality and Cost.....	16

REACH UPDATE

July 2023: Updated tools - New IUCLID service release	18
---	----

JANET'S CORNER

Labs offer so many ways to cool off but you may need to think carefully which one to try.....	19
---	----

HAZARD ALERT

Oxalic Acid	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

JUL. 21, 2023

GOSSIP

Van der Waals crust behind simple parameter that can describe chemical bonds.....	26
Researchers explore new methods for optimizing carbon-based catalysts	28
Beyond reduction cocatalysts: A new paradigm for the role of metal cocatalysts in photocatalysis.....	30
Study shows that the translation of protein by microglia supports efficient phagocytosis	31
First artificial synthesis of tanzawaic acid B may lead the way to new antibiotics	34
Unlocking the power of molecular crystals: A possible solution to nuclear waste.....	35
Scientists develop revolutionary new approach to designing catalysts for chemical reactions	37
Blamed for fouling the environment, polyester may help save it.....	39
Scientists overcome NH ₃ synthesis shortcomings	42

CURIOSITIES

Humans may soon grow new teeth, with promising drug trial set	44
W.Va. Alzheimer's Association speaks on new FDA approved medication treatment.....	45
Research team develops biosensor that could lead to quick and inexpensive test for osteoporosis risk.....	46
'Stunning' discovery: Metals can heal themselves	47
Scientists discover new structures for unique hybrid materials by altering their chemical bonds.....	49
Broken-down soy proteins can stop damage from excessive ice build-up and freezer burn.....	53
Researchers develop NMR method for drug structure elucidation	54
Chemical cocktail offers "potential to reverse aging with a single pill"	55
J&J subsidiary sues more talc researchers.....	56
Revolutionising RSV prevention	57

TECHNICAL NOTES

(Note: Open your Web Browser and click on Heading to link to section) ...62

Bulletin Board

Contents

JUL. 21, 2023

CHEMICAL EFFECTS.....	62
ENVIRONMENTAL RESEARCH.....	62
PHARMACEUTICAL/TOXICOLOGY	62
OCCUPATIONAL.....	62

Bulletin Board

Regulatory Update

JUL. 21, 2023

ASIA PACIFIC

Agricultural chemical products and approved labels

2023-07-11

Pursuant to the Agricultural and Veterinary Chemicals Code scheduled to the Agricultural and Veterinary Chemicals Code Act 1994, the APVMA hereby gives notice that it has registered or varied the relevant particulars or conditions of the registration in respect of the following products and has approved the label or varied the relevant particulars or conditions of the approval in respect of the containers for the chemical product, with effect from the dates shown.

Table 1: Agricultural products based on existing active constituents

Application no.	139550
Product name	Salrida Herbicide
Active constituent	750 g/kg sulfosulfuron
Applicant name	Shandong Rainbow International Co Ltd
Applicant ACN	N/A
Date of registration	3 July 2023
Product registration no.	93564
Label approval no.	93564/139550
Description of the application and its purpose, including the intended use of the chemical product	Registration of 'Salrida Herbicide' a water dispersible granule (WG) product containing 750 g/kg sulfosulfuron for the control of certain weeds in wheat and triticale

Application no.	139189
Product name	eChem Paraquat 360 Herbicide
Active constituent	360 g/L paraquat present as paraquat dichloride
Applicant name	eChem (AUST) Pty Ltd
Applicant ACN	089 133 095
Date of registration	3 July 2023
Product registration no.	93444
Label approval no.	93444/139189

Bulletin Board

Regulatory Update

JUL. 21, 2023

Application no.	139189
Description of the application and its purpose, including the intended use of the chemical product	Registration of a 360 g/L paraquat present as the paraquat dichloride Soluble Concentrate (SL) product for the control of a wide range of grasses and broadleaf weeds

Read More

APVMA, 11-07-23

<https://apvma.gov.au/sites/default/files/2023-07/Gazette%20No%2014%2C%20Tuesday%2011%20July%202023.pdf>

Australia's annual plastic consumption produces emissions equivalent to 5.7m cars, analysis shows

2023-07-23

The plastics consumed yearly by Australians have a greenhouse emissions impact equivalent to 5.7m cars – more than a third of the cars on Australia's roads, new analysis suggests.

A report commissioned by the Australian Marine Conservation Society and WWF Australia has found that the plastics consumed nationally in the 2019-20 financial year created 16m tonnes of greenhouse gases.

Quantifying the footprint of the production, transport and waste management of plastics consumed in Australia, the report projected that these emissions would more than double to 42.5m tonnes annually by 2050.

The Australian Marine Conservation Society plastics campaign manager, Shane Cucow, said research into the climate impact of plastics in Australia was previously limited because 87% of plastic consumed in the country was imported.

Australia generated more single-use plastic waste per capita than any country except Singapore.

"It really is quite alarming," Cucow said. "You think that Australia is quite a small country, but we're consuming a lot more plastic than others."

Kate Noble, the policy manager of WWF Australia's No Plastics in Nature program, said: "While plastic is not one of the biggest emitters, and the focus on the biggest emitters is absolutely right, it's also right that we

Bulletin Board

Regulatory Update

JUL. 21, 2023

should understand what the impact of our growing plastic consumption is in terms of emissions.”

[Read More](#)

The Guardian, 10-07-23

<https://www.theguardian.com/australia-news/2023/jul/10/australias-annual-plastic-consumption-produces-emissions-equivalent-to-57m-cars-analysis-shows>

Veterinary chemical products and approved labels

2023-07-11

Pursuant to the Agricultural and Veterinary Chemicals Code scheduled to the Agricultural and Veterinary Chemicals Code Act 1994, the APVMA hereby gives notice that it has registered or varied the relevant particulars or conditions of the registration in respect of the following products and has approved the label or varied the relevant particulars or conditions of the approval in respect of the containers for the chemical product, with effect from the dates shown.

Bulletin Board

Regulatory Update

JUL. 21, 2023

Table 4: Veterinary products based on existing active constituents

Application no.	134904
Product name	Gastratone Paste
Active constituent	50 mg/mL omeprazole
Applicant name	Endeavour Animal Health Pty Ltd
Applicant ACN	632 235 646
Date of registration	21 June 2023
Product registration no.	92238
Label approval no.	92238/134904
Description of the application and its purpose, including the intended use of the chemical product	Registration of a 50 mg/mL omeprazole oral paste product for use in the treatment of gastric ulcers in horses

Application no.	135533
Product name	Forthyron 400 µg Flavoured Tablets
Active constituent	400 µg/tablet levothyroxine sodium
Applicant name	Dechra Regulatory B.V.
Applicant ACN	N/A
Date of registration	1 July 2023
Product registration no.	92445
Label approval no.	92445/135533
Description of the application and its purpose, including the intended use of the chemical product	Registration of a 400 µg levothyroxine sodium tablet for thyroid replacement therapy in conditions of inadequate production of thyroid hormones in dogs

[Read More](#)

APVMA, 11-07-23

<https://apvma.gov.au/sites/default/files/2023-07/Gazette%20No%2014%2C%20Tuesday%2011%20July%202023.pdf>

Bulletin Board

Regulatory Update

JUL. 21, 2023

Approved active constituents

2023-07-11

Pursuant to the Agricultural and Veterinary Chemicals Code scheduled to the Agricultural and Veterinary Chemicals Code Act 1994, the APVMA hereby gives notice that it has approved or varied the relevant particulars or conditions of the approval of the following active constituents, with effect from the dates shown.

Table 6: Approved active constituents

Application no.	137572
Active constituent	Methoxyfenozide
Applicant name	Yingde Greatchem Chemical Co Ltd
Applicant ACN	N/A
Date of approval	20 June 2023
Approval no.	92996
Description of the application and its purpose, including the intended use of the active constituent	Approval of the active constituent methoxyfenozide for use in agricultural chemical products

Application no.	138205
Active constituent	Fenbendazole
Applicant name	Abbey Laboratories Pty Ltd
Applicant ACN	156 000 430
Date of approval	21 June 2023
Approval no.	93187
Description of the application and its purpose, including the intended use of the active constituent	Approval of the active constituent fenbendazole for use in veterinary chemical products

Application no.	138785
Active constituent	Flunixin meglumine
Applicant name	Ashish Life Science Pvt Ltd
Applicant ACN	NA
Date of approval	22 June 2026
Approval no.	93356

Bulletin Board

Regulatory Update

JUL. 21, 2023

Application no.	138785
Description of the application and its purpose, including the intended use of the active constituent	Approval of the active constituent flunixin meglumine for use in veterinary chemical products

Read More

APVMA, 11-07-23

<https://apvma.gov.au/sites/default/files/2023-07/Gazette%20No%2014%2C%20Tuesday%2011%20July%202023.pdf>

AMERICA

ACC Submits Comments on EPA's HON Proposal

2023-07-10

Today, the American Chemistry Council (ACC) and its Ethylene Oxide panel submitted comments to U.S. Environmental Protection Agency's ("EPA") on its proposed New Source Performance Standards for the Synthetic Organic Chemical Manufacturing Industry and National Emission Standards for Hazardous Air Pollutants for the Synthetic Organic Chemical Manufacturing Industry and Group I & II Polymers and Resins.

"ACC and our members are committed to being good neighbors and helping safeguard communities and the environment. The cities and towns where we operate include our families, friends, and employees.

"Since the 1980s, air emissions of criteria pollutants and other substances in the U.S. have fallen sharply, even as population and GDP have grown. From 2010 to 2020, Responsible Care facilities within the ACC membership have reduced HAPs emissions by approximately 24 percent. According to EPA Toxic Release Inventory (TRI), chemical emissions to the air have declined notably over the last 10 years, driving the decrease in total releases.

"While we support updating emissions standards in a technically feasible and economically efficient manner, we have substantial concerns with several aspects of EPA's proposal.

"As noted in our comments, EPA lacks the authority under the Clean Air Act (CAA) to conduct an additional and voluntary risk review for the source category after already satisfying its obligation under CAA Section 112 to review risk one time. Unfortunately, EPA's arbitrary decision has created a

Bulletin Board

Regulatory Update

JUL. 21, 2023

number of significant concerns throughout the proposal, many of which do not consider the substantial and immediate costs associated with them. These decisions will result in significant negative impacts to a broad cross-section of facilities impacted by the rule.

“We are particularly concerned with the EPA’s proposed requirements regarding ethylene oxide. Ethylene oxide is a versatile compound that’s used to help make countless everyday products. Ethylene oxide plays an important role in the development of batteries for electric vehicles and is used to support agriculture, oil and gas, as well as to develop semiconductors. Another important use of ethylene oxide is the sterilization of medical equipment. It is estimated that ethylene oxide sterilizes 20 billion medical devices each year, helping to prevent disease and infection.

“We oppose any rulemaking that uses the EPA’s flawed IRIS value for Ethylene Oxide. ACC and others have detailed the severe science-based flaws with the IRIS value that resulted in an overly conservative value that is below background levels of ethylene oxide. In fact, the IRIS program’s proposed toxicity value is 19,000 times lower than naturally occurring levels of ethylene oxide found in the human body. EPA should await the outcome of litigation in the D.C. Circuit prior to proceeding to use the IRIS value in its risk assessment for EO.

“We support strong, science-based regulations to protect our health and the environment. However, as detailed in our comments, the proposal as written could have substantial unintended consequences, even potentially resulting in facility shutdowns to meet EPA’s proposed flaring and maintenance vent restrictions. We have substantial concerns with several other aspects of EPA’s rulemaking for which revisions, further clarification, or potential withdrawal would improve this proposal.”

Read More

ACC, 10-07-23

<https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2023/acc-submits-comments-on-epa-s-hon-proposal>

Bulletin Board

Regulatory Update

JUL. 21, 2023

Fluorinated carbons, PFAS, found in nearly half of US tap water

2023-07-10

The results of a new study released last week by the US Geological Survey (USGS), a bureau of the US Department of the Interior, found that nearly half of all US tap water contain industry-made perfluoroalkyl and polyfluoroalkyl substances (PFAS), referred to as “forever chemicals” due to their stable molecular structures that make them highly persistent in the environment. Some PFAS may take over 1,000 years to degrade, if at all.

These synthetic substances, first developed during the Manhattan Project (the US government research project that produced the first atomic bomb) in 1945, are known for their heat-resistant and stain-resistant properties, and have become ubiquitous in the commercial fabric of society that include a wide range of consumer products, food packaging, nonstick cookware, waterproof clothing and firefighting foams. Because of their unique carbon-fluorine bond—one of the strongest chemical bonds in nature—they persist in the environment after seeping into the groundwater from landfills, wastewater treatment plants, waste incineration facilities and contaminated rain.

Read More

WSWS, 10-07-23

<https://www.wsws.org/en/articles/2023/07/10/tcwu-j10.html>

The Editorial Board: It’s time to keep a watchful eye on PFAS and consider further regulation

2023-07-09

There is a new family of chemicals to worry about. They are invisible, tasteless and odorless – and, according to the U.S. Environmental Protection Agency, they’re linked to cancer, high cholesterol, thyroid disease and other serious conditions.

The initials may vary – PFNA, PFOS or PFOA – but many experts believe a group of chemicals known collectively as PFAS share potentially deadly impacts on human health.

The EPA calls them “emerging contaminants,” and they’re known scientifically as per- and polyfluorinated alkyl substances, chemicals used to make fluoropolymer coatings and products that resist heat, oil, stains,

Bulletin Board

Regulatory Update

JUL. 21, 2023

grease and water. Another name for them is “forever chemicals,” because they do not degrade over time. A new study by the U.S. Geological Survey reports PFAS in at least 45% of the nation’s tap water. That includes Western New York tap water.

Clearly, regional drinking water systems must be rigorously monitored by municipal agencies for this new danger. Further regulations may be necessary and there are definitely ways residents can protect themselves and their families.

Mayville residents in Chautauqua County had to resort to bottled water when PFNA was found in the village’s source wells in 2020. The chemical is now gone, thanks to a new, uncontaminated well and the addition of a treatment system, but residents are worried about the long-term effects of what they unknowingly consumed. It’s speculated that the source of the PFNA contamination in the Mayville wells was aqueous film-forming foam, a fire suppressant area firefighters were training with from 2014 to 2018 at an emergency services complex in the village. If so, there could have been as much as six years of exposure for these residents.

Fire-fighting foam is only one of the many uses of these chemicals, which also go into stain-resistant clothing, moisture-resistant packaging and nonstick cookware.

We’re not going to get rid of them – at least not in the near future – but we can protect against them.

Monitoring: Whether a village of less than 2,000 or an urban center with more than 200,000, it’s important for municipalities to regularly monitor for the presence of PFAS. If concerning levels are found, there are treatment systems that can filter them out. New York State already requires such monitoring for PFOS and PFOA and more monitoring and notification laws are on the way.

Read More

The Buffalo News, 09-07-23

https://buffalonews.com/opinion/editorial/the-editorial-board-its-time-to-keep-a-watchful-eye-on-pfas-and-consider-further/article_b0f68a00-1c08-11ee-a050-2f4ca2001b15.html

Bulletin Board

Regulatory Update

JUL. 21, 2023

EUROPE

Hormones All Over The Place? Endocrine Disruptors Could Be To Blame

2023-07-04

Our hormones are important for regulating so many areas of our bodies. From menstrual cycles to gut health to our mental wellness, it’s important to keep our hormones in balance.

But TikTok health experts and scientists are revealing that we should be concerned about how much endocrine-disrupting chemicals we’re coming into contact with daily, due to how much they can affect our hormones.

We’re likely to see much more about hormone health going forward says TikTok wellness expert Hannah Bronfman, “We’ve never seen more women wanting to come off birth control, wanting to learn more about their hormones, or cycle syncing.

“We’re going to see so many products coming out that are labelled with ‘endocrine-safe’”

So, what exactly are endocrine disruptors, and how wary should we be of them?

It’s thought that endocrine disruptors throwing our hormones out of whack could have serious implications for our bodies. For example, one study showed that EDCs (endocrine-disrupting chemicals) could have potential links to polycystic ovary syndrome (PCOS).

However, Dr. Karl Nadolsky, an endocrinologist at Spectrum Health shared that it’s “difficult to quantify” how bad endocrine disruptors are, based on the data we have.

“We certainly need more research, but there are strong associations with obesity, insulin resistance or type 2 diabetes, PCOS, gestational diabetes, reduced birthweight, reduced semen quality, endometriosis and breast or prostate cancer,” he says.

Bulletin Board

Regulatory Update

JUL. 21, 2023

The level of danger these chemicals cause you can depend on “where you are in life”, too, says Dr Jamie Alan, associate professor of pharmacology and toxicology at Michigan State University said in an interview.

[Read More](#)

Huffpost, 04-07-23

https://www.huffingtonpost.co.uk/entry/hormones-all-over-the-place-endocrine-disruptors-could-be-to-blame_uk_64a409e3e4b030efa122b71b

End-of-life vehicles: EU must balance conflicting waste, product, and chemical objectives

2023-07-13

The EU has unveiled its End-of-life vehicles (ELV) Regulation to boost vehicle circularity while pushing ambitious recycled content targets. ACEA is concerned that the proposal could duplicate or complicate existing rules and industry best practices on sustainable design. Law makers must instead ensure a coherent regulatory environment that enables manufacturers to scale up vehicle circularity investments.

The European auto recycling value chain delivers an exceptional reuse and recovery rate of around 95%. For cars, the recycling rate stands at a noteworthy 85%, with another 10% of materials used for energy. The industry’s commitment to ‘design for sustainability’ practices and increasing the use of recycled materials in new vehicles is central to this European circular economy success story.

“We are committed to the design-for-sustainability principle, and high recycling rates prove that these practices work,” noted Sigrid de Vries, ACEA’s Director General. “While the proposal is pushing for ambitious recycled content targets, European auto manufacturers believe law makers should instead focus on ensuring a coherent legislative framework that balances conflicting waste, product, and chemical regulations for vehicles,” she added. “We are also concerned that the Commission has not sufficiently examined imbalances in the demand and supply of recycled materials and existing technology gaps before proposing these ambitious targets.”

Vehicles are one of the most complex products to design on the market; they comprise a diverse range of parts composed of multiple materials where recycling technologies may not yet be available. This is particularly

Bulletin Board

Regulatory Update

JUL. 21, 2023

true for the increasingly greener and more intelligent vehicles entering the market. For example, some newer models use carbon fibres to reinforce plastic parts – these novel materials can reduce carbon footprint and energy consumption but are challenging to recycle and can contaminate waste streams.

Auto makers invest around one-third of the EU’s R&D spend, much of which is pumped into technologies to boost vehicle circularity. However, the Commission’s proposal risks duplicating or complicating existing rules and industry best practices, hindering these vital investments. Instead, the regulation should better account for vehicles’ increasing complexities and specificities, including longevity, durability, and reparability.

ACEA also believes that the current ELV and the 3R Type-Approval directives should not be merged. Their separation provides manufacturers with more certainty, eg for investments in recycling technologies for the lithium-ion batteries essential to the electric vehicles transition. “These technologies are not available at an industrial scale when new vehicle models are first placed on the market. Realistically, they can only reach lab scale around 15 years before their end of life,” notes de Vries. “The co-legislators must ensure sufficient R&D lead times or risk undermining certainty for vehicle circularity investments.”

[Read More](#)

ACEA, 13-07-23

<https://www.acea.auto/press-release/end-of-life-vehicles-eu-must-balance-conflicting-waste-product-and-chemical-objectives/>

INTERNATIONAL

Compostable Plastic Is Garbage

2023-07-06

Sure, these products could be better than regular old plastic. Right now, they’re not.

In 2023, the options for a build-your-own fast-casual lunch can include wild Alaskan salmon, harissa honey chicken, cauliflower shawarma, seasonal roasted zucchini, preserved lemon vinaigrette, za’atar bread crumbs, creamy vegan feta, and skhug. But whatever you choose, it will all inevitably be served in a compostable bowl. As an office worker blessed (and cursed) with endless overpriced meal options, I have shoveled way

Bulletin Board

Regulatory Update

JUL. 21, 2023

too much random food into my mouth from a compostable vessel, using a compostable utensil.

The forks, in particular, are not prone to subtlety: Some are embossed with the word compostable; others are green, in case anyone forgets they are “green.” But the compostable-packaging takeover has been tough to miss. Perhaps you have gotten leftovers in a compostable container, stuffed groceries into a compostable produce bag, or sipped coffee out of a compostable straw. Compostable packaging “is growing, and growing a lot,” David Henkes, a food-industry analyst at Technomic, told me. By 2021, 7 percent of all food-service packaging was compostable, Henkes said; its share has almost certainly grown since then, especially in major cities. Among the companies that now use it: Trader Joe’s, Whole Foods, Cava, Sweetgreen, Panera Bread, Taco Bell, and Frito-Lay.

But although compostable packaging is easy to spot, compost bins to put it in are not. All of my office forks and soggy fiber packaging have gone straight into the kitchen trash, just like normal plastic would. Only a tiny fraction of this compostable packaging and plastic, it turns out, is actually getting composted. Even if restaurants, homes, and office buildings have composting bins, in most places this pile of compostable trash has nowhere to go: America doesn’t have the composting infrastructure to deal with it. These products might have the potential to be better for the planet than traditional plastic, but right now, compostable plastic is just plastic.

What makes plastic so great is also what makes it so terrible. The substance, created from fossil fuels, is cheap, moldable, and so durable that most plastic that humans have ever produced still exists. Compostable plastic is made by chemically manipulating plant sugars such as corn starch and sugar cane to achieve similar properties; the flimsier, cardboardlike compostable bowls are molded out of bamboo and other plant fibers. The promise of these products is the same: Whereas a plastic fork or bowl might get used for just a few minutes before lingering in the environment forever, a compostable version degrades over time, not unlike an apple core you throw away in the woods. Only more slowly. Much more slowly.

Read More

The Atlantic, 06-07-23

<https://www.theatlantic.com/science/archive/2023/07/compostable-plastic-trash/674626/>

Bulletin Board

Regulatory Update

JUL. 21, 2023

Overly Broad PFAS Restrictions Could Endanger Healthcare Quality and Cost

2023-07-14

PFAS are under regulatory and legislative assault at the federal and state levels. In the zeal to eliminate some of these chemistries, however, regulators and lawmakers may undermine the ability to provide life-saving healthcare in the United States.

That’s because products with PFAS are used in a wide variety of ways in healthcare settings, such as medical devices, medicines and personal protective equipment. These uses improve healthcare outcomes and reduce costs.

The unique qualities of PFAS are what make them so important in the healthcare context. PFAS - per- and poly-fluoroalkyl substances - are a diverse family of chemistries with different varieties in solid, liquid, and gaseous forms. The carbon-fluorine bond in PFAS makes the chemistries uniquely durable and nonreactive, and therefore very difficult to substitute in healthcare settings.

Accordingly, without an alternative that is both scientifically and economically feasible, overly broad restrictions on PFAS could have grave public health consequences for America.

In medical implants and devices, PFAS help provide resistance to infections, friction, and clots. They are used in catheters that drain fluids collected in the body, stents that hold open coronary arteries, surgical meshes that repair hernias, as well as needles for surgical biopsies to diagnose cancer.

Without PFAS, these devices could be at a higher risk of implant failure or clogging, and may need to be replaced more often, resulting in higher medical costs and more potential pain and risk for patients.

In equipment used for diagnosis and treatment, PFAS are integral to everything from ventilators to COVID-19 test kits. PFAS are used in X-Ray film to identify internal injuries, video endoscopes to detect gastrointestinal issues, and protein-resistant and sterile components like filters, tubing, and seals for kidney dialysis machines.

Bulletin Board

REACH Update

JUL. 21, 2023

July 2023: Updated tools - New IUCLID service release

2023-07-03

Helsinki, 3 July 2023 - A new service release of IUCLID 6 (from 7.0.5 onwards) includes improvements and fixes that are relevant to SCIP users such as:

- Alignment of the validation assistant with the official Candidate List update on 14 June.
- A fix on the user interface view of the mixture category (no impact on the format).

Note for System-to-System users: The fix in the mixture category user interface corrected one error in the hierarchy used to provide the full text display for a picklist entry. The format was not affected, i.e., no modifications of the phrase ids or the phrase texts were done. The new picklist file is available at: <https://echa.europa.eu/scip-format>.

You can access the full release notes and download the new version of IUCLID from the IUCLID website. Installations for users of ECHA Cloud services will be automatically upgraded during the week of the release.

Read More

ECHA, 03-07-23

https://echa.europa.eu/-/updated-tools-new-iuclid-service-release-1#msd_ynttrid=SNKGWEHI3UvQHNHqvEvb7kk9SARAScc4Eukf27yYg6A

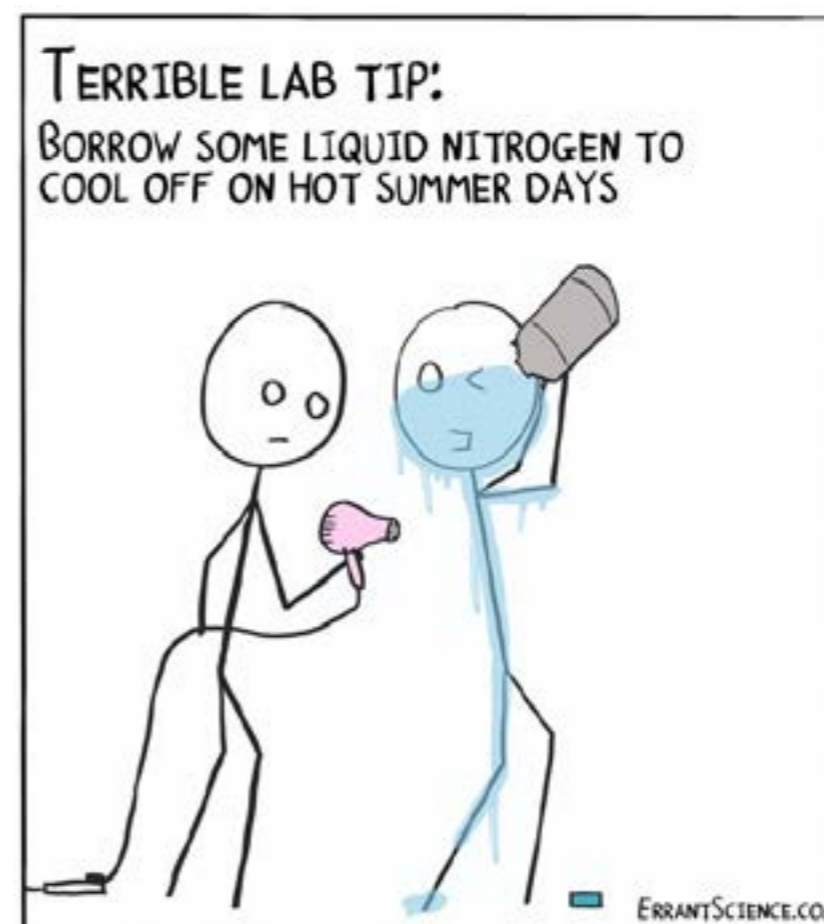
Bulletin Board

Janet's Corner

JUL. 21, 2023

Labs offer so many ways to cool off but you may need to think carefully which one to try

2023-07-21



<https://pbs.twimg.com/media/FssaVyWXgAEjEk?format=jpg&name=small>

Bulletin Board

Hazard Alert

JUL. 21, 2023

Oxalic Acid

2023-07-21

USES [1,2]

Oxalic acid is used in a range of chemical applications. Its primary use is as an ingredient in cleaning agents. Its corrosive nature means it is used in a range of bleaches, detergents, cleaning products, and as a rust remover. The acid is also used across the board as a sterilising agent, including in corporate and medical industries. Oxalic acid is used as a bleach in textile mills and factories and in mineral processing.

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Routes of Exposure

Oxalic acid is naturally occurring in a range of vegetables, including potatoes, leafy greens, broccoli, and sprouts.

Leafy greens, such as spinach, are the most concentrated source of oxalates (in regards to vegetables).

Vegetables that are high in the acid are not dangerous in small doses.

More dangerous routes of exposure are from the cleaning products where oxalic acid is included as an ingredient.

HEALTH EFFECTS [4]

Acute Health Effects

Severity of symptoms depend on the level and type of exposure.

Acute doses of oxalic acid can occur if large quantities of the acid are accidentally ingested—as a pure substance, or through vegetables that are highly concentrated. High levels of ingestion can cause death. Oxalic acid crystals can cause chemical burns, and acute exposure to the vapour can result in internal chemical burns.

Chronic Effects

Chronic exposure to oxalic acid is toxic to multiple body systems. Long term exposure to the acid can corrode tissue throughout the body. This includes on the mucosa of the mouth, the oesophagus, and the stomach. It can also cause great thirst, bloody vomit, convulsions, coma, and

Bulletin Board

Hazard Alert

JUL. 21, 2023

death. Over time, oxalate crystals can break down in the body, forming kidney stones. This can cause various gastrointestinal complications and/or kidney failure. People who consume a lot of vitamin C are also in the higher risk category, as when the vitamin is broken down, it releases oxalic acid, which can, again, result in kidney stones.

SAFETY

First Aid Measures [4]

Ingestion: DO NOT INDUCE VOMITING. If spontaneous vomiting occurs, place the victim's head below their hips to prevent the acid moving into their lungs. Get immediate medical attention.

Skin contact: Remove all contaminated clothing, footwear and accessories. Do not re-wear clothing until it has been thoroughly decontaminated. Immediately rinse affected areas with plenty of water. If symptoms persist, contact a doctor immediately.

Eye contact: Flush eyes (including under the eyelids), with water for several minutes. Check for, and remove, any contact lenses (if easy to do so). Continue rinsing. If irritation persists, contact a medical professional.

Inhalation: Take victim to the nearest fresh air source and monitor their breathing. Keep the victim warm. If the victim is not breathing, and you are qualified, you may perform CPR with a one-way valve or protective mask. Immediately contact a medical professional.

General: Never administer anything by mouth to an unconscious, exposed person.

Exposure Controls [4]

Engineering controls: Emergency eyewash fountains and quick-drench areas should be accessible in the immediate area of the potential exposure. Ensure there is adequate ventilation. Use a local exhaust ventilation or process enclosure, to limit the amount of acid in the air.

Personal Protection

Personal protection: Safety glasses, protective and dustproof clothing, gloves, an apron and an appropriate mask or dusk respirator. Wear impervious shoes. Do not wear contact lenses. For specifications regarding other PPE, Follow the guidelines set in your jurisdiction.

Bulletin Board

Hazard Alert

JUL. 21, 2023

REGULATION

United States

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average (TWA) concentration limit for oxalic acid of 1mg/m³.

Australia

Safe Work Australia has set an 8-hour time TWA for oxalic acid of 1mg/m³.

REFERENCES

1. http://acidpedia.org/oxalic_acid/
2. https://en.wikipedia.org/wiki/Oxalic_acid
3. <https://medical-dictionary.thefreedictionary.com/oxalic+acid+poisoning>
4. https://www.statlab.com/pdfs/sds/Oxalic_Acid_2_Safety_Data_Sheet.pdf
5. <https://diggersaustralia.com.au/wp-content/uploads/sds/Rust%20and%20Stain%20Cleaner%20%28Oxalic%20Acid%29%20v4.pdf>

Bulletin Board

Gossip

JUL. 21, 2023

Exclusive: WHO's cancer research agency to say aspartame sweetener a possible carcinogen

2023-07-14

Aspartame, used in products from Coca-Cola diet sodas to Mars' Extra chewing gum and some Snapple drinks, will be listed in July as "possibly carcinogenic to humans" for the first time by the International Agency for Research on Cancer (IARC), the World Health Organization's (WHO) cancer research arm, the sources told Reuters.

The IARC ruling, finalised earlier this month after a meeting of the group's external experts, is intended to assess whether something is a potential hazard or not, based on all the published evidence.

It does not take into account how much of a product a person can safely consume. This advice for individuals comes from a separate WHO expert committee on food additives, known as JECFA (the Joint WHO and Food and Agriculture Organization's Expert Committee on Food Additives), alongside determinations from national regulators.

However, similar IARC rulings in the past for different substances have raised concerns among consumers about their use, led to lawsuits, and pressured manufacturers to recreate recipes and swap to alternatives. That has led to criticism that the IARC's assessments can be confusing to the public.

JECFA, the WHO committee on additives, is also reviewing aspartame use this year. Its meeting began at the end of June and it is due to announce its findings on the same day that the IARC makes public its decision – on July 14.

Since 1981, JECFA has said aspartame is safe to consume within accepted daily limits. For example, an adult weighing 60 kg (132 pounds) would have to drink between 12 and 36 cans of diet soda – depending on the amount of aspartame in the beverage – every day to be at risk. Its view has been widely shared by national regulators, including in the United States and Europe.

An IARC spokesperson said both the IARC and JECFA committees' findings were confidential until July, but added they were "complementary", with IARC's conclusion representing "the first fundamental step to understand carcinogenicity". The additives committee "conducts risk assessment, which determines the probability of a specific type of harm (e.g. cancer) to occur under certain conditions and levels of exposure."

LONDON, June 29 (Reuters) - One of the world's most common artificial sweeteners is set to be declared a possible carcinogen next month by a leading global health body, according to two sources with knowledge of the process, pitting it against the food industry and regulators.

Bulletin Board

Gossip

JUL. 21, 2023

However, industry and regulators fear that holding both processes at around the same time could be confusing, according to letters from U.S. and Japanese regulators seen by Reuters.

“We kindly ask both bodies to coordinate their efforts in reviewing aspartame to avoid any confusion or concerns among the public,” Nozomi Tomita, an official from Japan’s Ministry of Health, Labour and Welfare, wrote in a letter dated March 27 to WHO’s deputy director general, Zsuzsanna Jakab.

The letter also called for the conclusions of both bodies to be released on the same day, as is now happening. The Japanese mission in Geneva, where the WHO is based, did not respond to a request for comment.

DEBATE

The IARC’s rulings can have huge impact. In 2015, its committee concluded that glyphosate is “probably carcinogenic”. Years later, even as other bodies like the European Food Safety Authority (EFSA) contested this, companies were still feeling the effects of the decision. Germany’s Bayer (BAYGn.DE) in 2021 lost its third appeal against U.S. court verdicts that awarded damages to customers blaming their cancers on use of its glyphosate-based weedkillers.

The IARC’s decisions have also faced criticism for sparking needless alarm over hard to avoid substances or situations. It has four different levels of classification - carcinogenic, probably carcinogenic, possibly carcinogenic and not classifiable. The levels are based on the strength of the evidence, rather than how dangerous a substance is.

The first group includes substances from processed meat to asbestos, which all have convincing evidence showing they cause cancer, IARC says.

Working overnight and consuming red meat are in the “probable” class, which means that there is limited evidence these substances or situations can cause cancer in humans and either better evidence showing they cause cancer in animals, or strong evidence showing that they have similar characteristics as other human carcinogens.

The “radiofrequency electromagnetic fields” associated with using mobile phones are “possibly cancer-causing”. Like aspartame, this means there is either limited evidence they can cause cancer in humans, sufficient evidence in animals, or strong evidence about the characteristics.

The final group - “not classifiable” - means there is not enough evidence.

Bulletin Board

Gossip

JUL. 21, 2023

“IARC is not a food safety body and their review of aspartame is not scientifically comprehensive and is based heavily on widely discredited research,” Frances Hunt-Wood, secretary general of the International Sweeteners Association (ISA), said.

The body, whose members include Mars Wrigley, a Coca-Cola (KO.N) unit and Cargill, said it had “serious concerns with the IARC review, which may mislead consumers”.

The International Council of Beverages Associations’ executive director Kate Loatman said public health authorities should be “deeply concerned” by the “leaked opinion”, and also warned it “could needlessly mislead consumers into consuming more sugar rather than choosing safe no- and low-sugar options.”

Aspartame has been extensively studied for years. Last year, an observational study in France among 100,000 adults showed that people who consumed larger amounts of artificial sweeteners – including aspartame – had a slightly higher cancer risk.

It followed a study from the Ramazzini Institute in Italy in the early 2000s, which reported that some cancers in mice and rats were linked to aspartame.

However, the first study could not prove that aspartame caused the increased cancer risk, and questions have been raised about the methodology of the second study, including by EFSA, which assessed it.

Aspartame is authorised for use globally by regulators who have reviewed all the available evidence, and major food and beverage makers have for decades defended their use of the ingredient. The IARC said it had assessed 1,300 studies in its June review.

Recent recipe tweaks by soft drinks giant Pepsico (PEP.O) demonstrate the struggle the industry has when it comes to balancing taste preferences with health concerns. Pepsico removed aspartame from sodas in 2015, bringing it back a year later.

Listing aspartame as a possible carcinogen is intended to motivate more research, said the sources close to the IARC, which will help agencies, consumers and manufacturers draw firmer conclusions.

But it will also likely ignite debate once again over the IARC’s role, as well as the safety of sweeteners more generally.

Bulletin Board

Gossip

JUL. 21, 2023

Last month, the WHO published guidelines advising consumers not to use non-sugar sweeteners for weight control. The guidelines caused a furore in the food industry, which argues they can be helpful for consumers wanting to reduce the amount of sugar in their diet.

(This June 29 story has been corrected to drop the reference to aspartame being removed from PepsiCo products in 2020, in paragraph 25. A PepsiCo spokesperson corrected an earlier statement from an outside company spokesperson)

Reporting by Jennifer Rigby and Richa Naidu Editing by Michele Gershberg, Mark Potter and Susan Fenton

Reuters, 2023-07-14

<https://reuters.com>

Van der Waals crust behind simple parameter that can describe chemical bonds

2023-07-17

'The [van der Waals] crust is at a distance from the nucleus larger than the covalent radius but shorter than the van der Waals radius, it's a region where a host of weakly attractive interactions occur,' explains Santiago Álvarez, from the University of Barcelona, who developed the parameter alongside Jorge Echeverría from the University of Zaragoza.

The duo rationalised that a penetration index based on the overlap between the van der Waals crusts of two atoms can describe all chemical bonds between atoms. A single covalent bond would have a value of 100% on the penetration index, with total overlap of the van der Waals crust. A traditional van der Waals force would have a value of 0%. There are instances of values outside this range, with double and triple bonds having values higher than 100%. Values in the negative range indicate interactions that occur outside of the van der Waals crust.

Álvarez says he and Echeverría decided to develop the system because 'at the present time, we use bond distances to calibrate the degree of interaction of the atoms. But if you have two small atoms, they are of course [at a] much shorter distance than two heavier atoms with a similar bond ... The purpose is to get a parameter that measures the degree of interaction between two atoms, which is independent of the size of the atoms.' Álvarez goes on to explain that the overlap defined by the penetration index will be useful as it can give a quantitative meaning to

Bulletin Board

Gossip

JUL. 21, 2023

all combinations of interatomic distances and 'calibrate chemical bonding and structure across much wider sets of molecules' than had previously been looked at.

A 'herculean effort'

One area they calculated penetration indexes for was hydrogen bonding. Variations in the strength of hydrogen bond interactions correlated with penetration index values. Describing such bonding with a numerical value will allow chemists to be more precise than terms such as 'weak' and 'strong' hydrogen bonding. Examples of strong hydrogen bonding, such as those found in H-H+ and H₂O+--H-OH₂, both have penetration indexes above 50%. Weaker interactions were calculated to have extremely low and at times a negative penetration index.

Other areas they analysed included arenes and cyclopentadiene bonding, and metals interactions between ions of the same sign in ionic solids. Alvarez says the method can be used in any area of chemistry where interatomic distances are relevant. He hopes it will 'provide a better descriptor for the formation and dissociation of bonds in reactions'. He also expects the parameter will mean chemists rethink how they describe certain interactions, such as those found in frustrated Lewis pairs or adsorption mechanisms.

Martin Rahm, a theoretical chemist from Chalmers University of Technology in Sweden describes how Álvarez and Echeverría applied their quantitative penetration index to numerous areas of chemistry as a 'herculean effort'. He adds that while the penetration index concept is simple, 'simple methods can sometimes be very powerful ways to describe things'.

Thomas Manz, from New Mexico State University in the US, is also a theoretical chemist. He says the penetration index is a 'useful tool to quantitatively interpret diverse chemical bonds' but says the work has some fundamental limitations. 'Because this penetration index is based on a chemical element's covalent radius and van der Waals radius, this penetration index does not strongly correlate with the electron density overlaps between atoms in ionic crystals.' Manz says this is because the index is based on covalent radii rather than ionic radii.

Chemistry World, 17 July 2023

<https://chemistryworld.com>

Bulletin Board

Gossip

JUL. 21, 2023

Researchers explore new methods for optimizing carbon-based catalysts

2023-07-19

However, in work recently reported in Nature Communications, University of Delaware's Dion Vlachos and researchers in the Catalysis Center for Energy Innovation (CCEI), with collaborators from Brookhaven National Laboratory, made some surprising findings as they were developing techniques to better understand the role oxygen plays in how carbon-based catalysts perform.

According to Vlachos, what they found turned some of what they knew about chemistry upside down.

Not all oxygens are the same

Despite their utility, carbons are not well understood. They are not uniform either. Carbon materials sometimes have oxygen in them, and this oxygen can come in multiple different forms—as an alcohol, aldehyde, ketone or acid. One open question is what the oxygen in these carbon materials does.

So, Vlachos and a team of researchers took carbon molecules and systematically introduced more and more oxygen, then characterized the resulting material using spectroscopic techniques to measure how much and what type of oxygen was present. The researchers did this for a library of about 10 to 15 materials, then performed reactions using the different oxygenated carbons. This allowed them to correlate the carbon material's reactivity with the amount and type of oxygens present using machine learning tools.

The team's work showed a connection between the amount and type of oxygen present and performance, including which oxygens are more active. Counterintuitively, the researchers also found something surprising: long-range effects from aromatic rings far away from a catalyst site can sometimes cause the alcohol groups of the carbon to become more acidic than familiar acidic carbon functional groups found in organic chemistry small acids.

At first, the researchers were surprised, but then they did some calculations and confirmed that the effect was due to the alcohol-based oxygenated carbons in aromatic rings.

"Carbon has aromatic rings," said Vlachos, the Unidel Dan Rich Chair in Energy and director of CCEI, an Energy Frontier Research Center

Bulletin Board

Gossip

JUL. 21, 2023

supported by the U.S. Department of Energy. "And the more carbon rings that are added to a material, the greater the chance of creating a regional phenomenon where long-range effects from far away can have a controlling effect on the activity of the catalyst sites."

This is not the case with typical catalysis chemistry, where the effect is very local. For example, bond A affects bond B and that's it.

"The whole chemistry thinking is upside down. This was not expected," he added.

In terms of applications, Vlachos said this means if researchers want to create a more acidic carbon catalyst, they will need to use more alcohol functional groups, in this case, hydroxyls.

The researchers used advanced techniques to validate the mathematical modeling results and characterize what would happen to the oxygen in materials at near-real world conditions, while the chemistry was occurring.

"The University of Delaware team accomplished an impressive feat by using advanced tools and methods to unravel a complicated catalytic system," said Anibal Boscoboinik, a materials scientist with the Center for Functional Nanomaterials, a U.S. Department of Energy (DOE) Office of Science User Facility at DOE's Brookhaven National Laboratory. "We are delighted to have played a part in this significant achievement by conducting measurements using a special kind of spectroscopy at the Center for Functional Nanomaterials."

With this new methodology for determining what each part of the chemistry is doing, the research team can test different techniques for making materials to see what approach has the best effect. For example, are all oxygen molecules equally effective at speeding up catalytic reactions, or are some better than others? Vlachos also is curious whether the oxygen source can be used to disperse metals for reactions. Traditional methods for introducing oxygen into a reaction to make materials are corrosive, so finding greener ways to do this could bring more sustainable processes closer to fruition.

Phys Org, 19 July 2023

<https://phys.org>

Bulletin Board

Gossip

JUL. 21, 2023

Beyond reduction cocatalysts: A new paradigm for the role of metal cocatalysts in photocatalysis

2023-07-14

However, rational design of next-generation photocatalysts is hindered by the lack of molecular-level understanding of hole-driven oxidation kinetics, active sites, and resultant photocatalytic performance.

The research group led by Toshiki Sugimoto, Associate Professor at the Institute for Molecular Science, has demonstrated that metal cocatalysts loaded on a semiconductor photocatalyst play critical roles in modulating surface oxidation kinetics and resultant oxidation selectivity.

Real-time mass spectrometric analysis of gaseous products under systematically-controlled methane pressures revealed that the Pt-loaded Ga₂O₃ photocatalyst predominantly promoted the total oxidation of methane toward CO₂ on its surface, while the Pd-loaded photocatalyst exhibited a higher selectivity for C₂H₆ formation through the gas-phase coupling of free •CH₃.

This difference in methane oxidation kinetics was corroborated by operando infrared absorption spectroscopy that observed surface intermediates under working conditions. Moreover, the research group demonstrated that the Pt cocatalyst itself was oxidized by photogenerated holes.

These experimental results demonstrated the critical roles of metal cocatalysts as a reservoir of photogenerated holes and an effective reaction site for methane oxidation processes. Generally, metal cocatalysts have been recognized for half a century as reduction cocatalysts that exclusively accumulate photogenerated electrons and promote reduction reactions such as H₂ evolution.

Based on this conventional assumption, hole-accumulated metal cocatalysts are assumed to act as charge recombination centers and inhibit photocatalysis. In contrast, this research group verified that both H₂ evolution and methane oxidation were accelerated by metal cocatalyst loading. These experimental results indicate that photogenerated electrons and holes are separately trapped at different metal cocatalyst particles while avoiding charge recombination and promoting redox reactions.

Thus, the systematic operando investigation of the photocatalytic oxidation of methane (i.e., the most inert and simplest organic compound)

Bulletin Board

Gossip

JUL. 21, 2023

and water (i.e., one of the key molecules in photocatalysis) provides a new paradigm for the role of metal cocatalysts in photocatalysis and thus contributes to developing a cocatalyst-based surface engineering strategy for controlling non-thermal oxidation reactions.

Phys Org, 14 July 2023

<https://phys.org>**Study shows that the translation of protein by microglia supports efficient phagocytosis**

2023-07-13

Researchers at Washington University School of Medicine recently carried out a study exploring if microglial processes can support the local translation of protein. Their findings, published in Nature Neuroscience, suggest that microglia create new proteins within their peripheral processes, particularly at sites where they are “ingesting” (i.e., phagocytosing) cells or other targets that are no longer needed in the body.

“When you think about how complex the shapes of brain cells are, you realize they have this fundamental problem when it comes to gene expression,” Joseph D. Dougherty, one of the researchers who carried out the study, told Medical Xpress. “Think of a neuron with its hundreds of little processes and synapses: to strengthen a given synapse after activity (i.e., to help encode a new memory), the cell needs new proteins at just that synapse—but not everywhere else. Yet, the genes that code for these proteins pretty much reside in just one place that is far from the synapse, specifically in the nuclear DNA.”

When cells create new protein, this protein is delivered to target locations inside the cell via a sophisticated translational process. Firstly, DNA (i.e., the material carrying genetic information) is transcribed to the nucleic acid RNA, which is then translated into protein.

“Over the last couple of decades, researchers realized that neurons have the ability to localize where that RNA is translated by moving mRNA and the translational machinery (ribosomes) to the activated synapses,” Dougherty explained. “It is sort of like shipping the plans and the factory to where you need a lot of new parts. While neurons are the most famous cells in the nervous system, if you look at other cells like astrocytes and microglia, they have the same challenge of a complex morphology with lots of processes that may need to act independently.”

Recent studies have found that some cells of the brain, including neurons, astrocytes, and oligodendrocytes, can transport pieces of the genetic code (RNA) from the nucleus out to their distal processes which may be several microns away, and then locally translate proteins from this code within the process itself. Yet whether microglia, immune cells that protect the brain from damage and disease, might be able to engage in this process remains poorly understood.

Bulletin Board

Gossip

JUL. 21, 2023

Microglia are tiny and yet functionally refined immune cells that protect the brain and the body from infections, diseases and traumatic injuries. While many studies have investigated the functions and processes of these vital immune cells, their ability to locally translate protein within their processes has rarely been explored before.

“As the resident immune cells, microglia are both the gardeners and the watchdogs of the brain, with 5–10 little processes that are continuously moving and surveying the surrounding cells, occasionally pruning excess synapses that are no longer needed and clearing any debris from injury or infection by a process called phagocytosis (i.e., surrounding and ‘eating’ debris and unwanted cells),” Dougherty said. “Our key question was does this phagocytosis, like strengthening a synapse in a neuron, also need new protein production? And if so, how might a process on one side of the cell turn on phagocytosis while the other processes are still in surveillance mode?”

The key hypothesis put forward by Dougherty and his colleagues is that just like neurons and astrocytes, microglia can also locally translate protein, as this allows them to act independently from other cells, performing their main functions while also translating protein if needed. To confirm this hypothesis, they would need to gather three key observations.

First, if their suspicions were true, microscopic examinations would unveil instructions for producing new proteins, known as mRNA, among microglial processes. Among these same processes, they should have also been able to detect ribosomes. Finally, after examining brain slices treated with specific compounds that highlight new protein translation, the researchers should find evidence of newly translated protein within the microglial processes.

“We also wanted to know what they were actually making out there,” Dougherty said. “We thus adapted some old biochemical methods from prior decades that were used to purify different fragments from ground up mouse brains by their size/density to enrich for processes of all cell types, and then paired this with a genetic trick to add a tag to ribosomes only in microglia.”

Dougherty and his colleagues only pulled ribosomes from microglial processes (which they had tagged using genetic tools) and sequenced the mRNAs they found on them. This allowed them to determine what proteins they were producing locally.

Bulletin Board

Gossip

JUL. 21, 2023

Interestingly, the researchers found that much of the genes translated by microglial processes were involved in phagocytosis (i.e., the “ingestion” of debris and unwanted cells). Overall, this suggests that the local translation of protein is a necessary step for phagocytosis.

“We asked whether blocking translation with classic ribosome-blocking drugs could block phagocytosis in brain slices, and it could,” Dougherty said. “While this told us translation was important, it didn’t tell us where it was important. My partner Mike Vasek had noticed that sometimes when we made these brain slices, we accidentally cut off just one process of a microglia. We started wondering if these were inert, or more like ‘The Thing’ from the Addams family, where maybe just this one process, detached from a nucleus, still conducted phagocytosis by itself?”

Dougherty, Vasek and their colleagues then conducted a final experiment to determine what would happen if they blocked protein translation. Their findings confirmed that microglial processes could act independently to engulf debris, and the translation of new protein allows them to do this most efficiently.

“Microglial processes are constantly moving—contacting hundreds of neighboring synapses and cells every hour,” Vasek, co-author of the paper, said. “They also do many different types of actions at their various contacts including pruning synapses, remodeling extracellular matrix, and phagocytosing an apoptotic cell. We found that microglia are making new protein within their peripheral processes and are making lots of new protein locally at sites where they are phagocytosing apoptotic cells and other targets.

“One exciting implication for our work is that it offers a possible explanation for how individual microglia can make proteins to execute a specific function in one distal part of its cell while making other subsets of proteins in other subcellular regions involved in other local tasks.”

The results gathered by this team of researchers offer new highly valuable insight into the complexity of microglial processes, while also confirming their ability to locally translate proteins without relying on protein “shipments” from the cell soma or center. In the future, they could pave the way for more research exploring microglial peripheral processes and protein translation, which could lead to more interesting discoveries.

“Now that we’ve established this happens, we are very interested in how they do this,” Dougherty added. “How do they localize the RNAs and ribosomes they need to the right location? What signals turn on local

Bulletin Board

Gossip

JUL. 21, 2023

translation when they sense debris? How fine-tuned is this process? And does this process break down in diseases of the brain? We are excited to pursue these questions and many others with the new toolkit we devised.”

Medical Xpress, 13 July 2023

<https://medicalxpress.com>

First artificial synthesis of tanzawaic acid B may lead the way to new antibiotics

2023-07-19

Unfortunately, the worldwide use (and abuse) of antibiotics led to the emergence of drug-resistant bacterial strains. Over time, bacteria that could normally be killed by a given antibiotic produced mutant offspring immune to it. These mutant strains are a major threat to public health, and the only safe course of action is to develop new antibiotic compounds.

Against this backdrop, a research team including Professor Isamu Shiina, Assistant Professor Takatsugu Murata and Mr. Hisazumi Tsutsui from the Tokyo University of Science (TUS) in Japan has now achieved a major breakthrough in the synthesis of new antibiotics. As reported in their paper published in ACS Omega in July 2023, the team achieved the first-ever gram-scale synthesis of tanzawaic acid B, which can serve as a candidate for the discovery of new drugs.

But what is tanzawaic acid B? In 1997, Professor Daisuke Uemura and colleagues working in the Tanzawa area of Japan isolated a series of organic polyketide compounds from the fungus *Penicillium citrinum*. These compounds were grouped together into what we now call the “tanzawaic” acid family, containing dozens of members ranging from A to Z1.

Tanzawaic acid B has attracted the most attention as it shares a common core structure with many tanzawaic acids, meaning that an artificial synthesis method for tanzawaic acid B could readily lead to synthesis methods for the rest.

However, synthesizing tanzawaic acid B from scratch is a challenging endeavor. The tanzawaic acids share a polysubstituted octalin skeleton—a structure composed of 10 carbon atoms in a tight pattern with multiple chemical groups at specific locations. The researchers synthesized this skeleton by utilizing a chain-like molecule that they had synthesized in a previous study. Then, by leveraging a carefully controlled intramolecular

Bulletin Board

Gossip

JUL. 21, 2023

Diels-Alder reaction, they made these chains preferentially “fold” into the desired octalin skeleton.

The next challenge was to precisely modify the octalin skeleton in multiple steps to produce tanzawaic acid B. As octalin has eight carbon atoms that can participate in stereochemical reactions, any desired substitution effectively competes with 255 other possible arrangements.

To tackle this issue, the researchers employed asymmetric alkylation and asymmetric Mukaiyama aldol reaction, which enabled them to produce the desired polysubstituted octalin compound tanzawaic acid B on gram scale.

Overall, this new synthesis technique could play a key role in the development of antibiotic drugs based on tanzawaic acids. Prof. Shiina said, “For more than 25 years since its discovery, the total synthesis of tanzawaic acid B had not been realized, until now. The present synthesis method will hopefully lead to the creation of various compounds for pharmaceuticals in the future, including new antibiotic candidates for multidrug-resistant bacteria.”

With a continuous, large-scale supply of tanzawaic acids, researchers will soon be able to test their interesting biological activities, including antibacterial, antimalarial, and antifungal properties. “Further improvements to the synthesis of tanzawaic acid B are currently underway, along with the investigations of its biological activity and synthetic analogs,” concludes Prof. Shiina.

Phys Org, 19 July 2023

<https://phys.org>

Unlocking the power of molecular crystals: A possible solution to nuclear waste

2023-07-19

Now, a team of University of Houston researchers has come up with an innovative solution for nuclear waste management: molecular crystals based on cyclotetrazobenzil hydrazones. These crystals, which are based on a discovery made by the team in 2015, are capable of capturing iodine—one of the most common radioactive fission products—in aqueous and organic solutions, and on the interface between the two.

“This last point is particularly salient because iodine capture on interfaces could prevent the iodine from reaching and damaging the specialized

In a world increasingly concerned about the environmental and geopolitical implications of fossil fuel usage, nuclear energy has resurfaced as a subject of great interest. Its ability to generate electricity at scale without greenhouse gas emissions holds promise as a sustainable clean energy source that could bridge society's transition away from fossil fuels to a net-zero future. However, nuclear power generation does produce radioactive waste. The safe management of nuclear waste remains a crucial challenge that must be addressed to gain public confidence in this transformative power solution.

Bulletin Board

Gossip

JUL. 21, 2023

paint coatings used in nuclear reactors and waste containment vessels," said Ognjen Miljanic, professor of chemistry and corresponding author of the paper detailing the breakthrough in Cell Reports Physical Science.

These crystals exhibit an astonishing iodine uptake capacity, rivaling that of porous metal-organic frameworks (MOFs) and covalent organic frameworks (COFs), which were previously deemed the pinnacle of iodine capture materials.

Alexandra Robles, the first author of the study and a former doctoral student who based her dissertation on this research, was working with the crystals in Miljanic's lab when she made the discovery. Her interest in finding a solution for nuclear waste led Robles to investigate using crystals to capture iodine.

"She ended up capturing iodine on the interface between the organic and water layers, which is an understudied phenomenon," said Miljanic, who added that this exceptional feature provides a crucial advantage. "When the material is deposited between the organic and aqueous layer, it essentially stops the transfer of iodine from one layer to another."

Not only does this process preserve integrity of reactor coatings and enhance containment, but the captured iodine could also then be moved from one area to another. "The idea here is that you capture it at a place where it's difficult to manage, and then you release it at a place where it's easy to manage," Miljanic said.

The other benefit of this catch-and-release technology is that the crystals can be reused. "If the pollutant just sticks to the regent, the whole thing has to be thrown away," he said. "And that increases waste and economic loss."

Of course, all of these great potentials still need to be tested in practical applications, which has Miljanic thinking of the next steps.

Molecules, crystals and octopi

Miljanic's team creates these tiny organic molecules containing only carbon, hydrogen and oxygen atoms using commercially available chemicals.

Each crystal is a ring-shaped structure with eight linear piece emanating from it, which has led the research team to nickname it "The Octopus."

Bulletin Board

Gossip

JUL. 21, 2023

"They are quite easy to make and can be produced at a large scale from relatively inexpensive materials without any special protective atmosphere," said Miljanic.

He estimated that he can currently produce these crystals at the cost of about \$1 per gram in an academic lab. In an industrial setting, Miljanic believes the cost would drop significantly.

These hungry little crystals are very versatile and can capture more than iodine. Miljanic and his team have used some of them to capture carbon dioxide, which would be another great step toward a cleaner, more sustainable world. In addition, "The Octopus" molecules are closely related to those found in materials used to make lithium-ion batteries, which opens the door to other energy opportunities.

"This is a type of simple molecule that can do all sorts of different things depending on how we integrate it with the rest of any given system," Miljanic said. "So, we're pursuing all those applications as well."

He is excited by the multitude of potential offered by the crystals and looking forward to exploring practical applications. His next goal is to find a partner who will help the scientists explore different commercial aspects.

Until then, the researchers are planning to further explore the kinetics and behaviors of the crystal structures to make them even better.

Phys Org, 19 July 2023

<https://phys.org>

Scientists develop revolutionary new approach to designing catalysts for chemical reactions

2023-07-19

Amino acids form the building blocks of proteins, which are crucial to carrying out processes in the human body and in nature. They can form a number of higher order structures when put into a sequence, with several types in existence, including the helix structure that is formed by DNA. Every protein uses a combination of some or all of these scaffolds to generate the huge diversity of functions they carry out through folding, a movement of the proteins that exposes different surfaces at different times for elements to interact with in a controlled manner.

Inspired by the way natural proteins are structured, scientists have developed artificial helices or helices not found in nature called

Chemists at King's College London have made a breakthrough in the way they develop artificial helix shapes for the amino acids that constitute proteins. These new synthetic shapes have the potential to transform processes such as chemical reactions through catalysis and advance medicine through novel drug development techniques.

Bulletin Board

Gossip

JUL. 21, 2023

“foldamers.” These artificial tools can support a whole range of applications, from drug development to materials science to chemical reactions through catalysis. Dr. André Cobb and his group have developed of a new type of helix that can bring about more controlled and various forms of catalysis, as published in *Angewandte Chemie International Edition*.

The new constructs developed by Cobb and his team fold in such a way that the important structural aspects required for successful catalysis are brought into close proximity together. “This breakthrough revolutionizes the development of catalysts because of its modular nature, whereby the elements can be easily changed depending on the reaction design,” said Cobb.

“Normally, this would be very difficult to achieve, as most catalysts are small molecular structures that do not present many options in terms of modification. These foldamer catalysts, however, are easy to modify and can be adapted, meaning the chemical reaction is more efficient, and it enable scientists to change the reaction type completely.”

For Cobb and his team, the long-term goal of this revolutionary new approach to catalyst design, will be to use the helix to select for the synthesis of mirror image molecules (known as enantiomers). Some molecules can be arranged in two different forms which are mirror images of each other but not superimposable (such as the left and right hands).

For example, a constituent of both lavender and coriander is the same molecule, yet one is formed of the right-handed molecule and the other of left-handed molecule, which lends them the different smells. The same is true of artificial proteins found in drugs and can result in completely different therapy outcomes, for example in the infamous case of thalidomide the drug which resulted in a shocking health scandal when it was given to pregnant women in the 1950s and resulted in fetal abnormalities.

There is a clear need therefore to have the ability to specifically make just one of these two mirror image forms. The Cobb Group hope to use the handedness of the catalytic helix (which can be right or left handed) to achieve this.

Cobb said, “This breakthrough will enable scientists to more carefully control and guide reactions, as they can select between left-handed and right-handed molecules via the handedness of the helix.”

Bulletin Board

Gossip

JUL. 21, 2023

“This in turn makes chemistry itself and chemical creations more adaptable, so we can start to build completely novel materials that computational chemists come up with that can address a whole range of needs, including drug discovery, the creation of sustainable materials and even enable methods to break down plastics.”

Phys Org, 19 July 2023

<https://phys.org>

Blamed for fouling the environment, polyester may help save it

2023-07-19

“People’s faces appeared blue. The houses were blue. The air was blue. Textile plants throw contaminants in the rivers—where people swim, where people get their drinking and cooking water,” says Hinestroza, the Rebecca Q. Morgan ‘60 Professor of Fiber Science and Apparel Design in the College of Human Ecology.

“That’s when I knew I had to switch the focus of my research,” he says. “As a chemical engineer and a textile chemist, I realized I could help solve some of these complex problems—they do not magically disappear.”

Now Hinestroza and a multidisciplinary team of Cornell chemists and engineers are reaching into a chemistry toolbox to clean up another formidable environmental foe: polyester textile waste.

The team has created a way to break down old polyester clothing and reuse some of its compounds to make fabrics that are fire resistant, anti-bacterial or wrinkle-free—and to halt the proliferation of garment waste in landfills.

It’s a circular approach that is in line with the United Nations Environment Program, which has begun a worldwide effort to end the developed world’s overconsumption of clothing. The number of times clothing gets worn has decreased 36% in the past two decades, according to the program.

In 2015, the U.S. Environmental Protection Agency estimated that each person in the United States discards more than 70 pounds of textiles annually. What’s worse, the report said, more than 85% of textile waste settles in landfills.

More than a decade ago, jet-lagged textile expert Juan Hinestroza landed in Xintang, China, and took a walk near a large creek. He noticed the water was a strange color—indigo blue, from highly toxic dyes, pigments and finishes dumped from a neighboring textile factory.

Bulletin Board

Gossip

JUL. 21, 2023

“Eventually, we are going to run out of space,” Hinestroza says. “We’re going run out of countries where we can send our textile garbage. The consequences are quite sad, but the solution is possible and it is in ourselves.”

Disrupting business as usual

Yelin Ko stands before the quiet hum of a laboratory fume hood in the Human Ecology Building and faces three magnetic stirrers. She loads a thimble full of colorful strips of polyester fabrics into a small round-bottom flask and then pours a sodium hydroxide solution to cover the textile.

With agitation, a little applied heat, ethanol and cooling water, those tiny pieces of polyester cloth—made of polyethylene terephthalate, the kind of goop from which plastic soda bottles also are made—will become a laboratory soup.

The scientists can then extract the old fabric’s monomers from the soup and use them to create linkers to be assembled into metal-organic frameworks, or MOFs. These MOF structures can be used to create coatings on clothing that protect people from germs or noxious gases, to shield firefighters from fire or other uses not yet imagined, says Ko, a doctoral student in the field of fiber science and a Fulbright Scholarship recipient who works in Hinestroza’s laboratory.

“Instead of using toxic solvents to recover the monomers to link the MOFs, we’re using ethanol and water as solvents—and we’re reclaiming the monomers significantly faster,” she says.

Phill Milner, assistant professor of chemistry and chemical biology in the College of Arts and Sciences, and Jin Suntivich, associate professor of materials science and engineering in Cornell Engineering, are also working with Hinestroza to develop these new chemistry techniques.

“With the right metal salts, like some copper salts, we can chemically grab the organic molecule from the monomers recovered from these digested textiles,” Milner said.

Within 30 minutes the polyester is depolymerized—safely and without environmental destruction—at room temperature.

“The chemistry is all governed by this idea of self-assembly, which is that the components themselves want to become an ordered structure,” Milner says. The scientists add copper salts to an acid to create a precursor solution, which they then bring to the soup of depolymerized polyester.

Bulletin Board

Gossip

JUL. 21, 2023

“The natural process keeps going until it builds an extended structure—the MOFs—which is what comes out of the solution.”

The team believes that the new techniques can disrupt the business-as-usual textile and apparel processes, which they say are unsustainable, says Suntivich, an electrochemist and material scientist. “Plastic recycling is a challenge obviously, so we’re going about it in this context. I’m seeing MOFs as just a way for me to enable the recycling of the material.”

However, the professors know that to succeed, their technique must be adaptable to existing industry practices, Hinestroza says.

Ideally, the team hopes that manufacturers use the MOF chemistry in existing infrastructure. “Trying to incorporate new equipment into new processes is always difficult,” he says. “You can develop a unique chemistry, but if you need new equipment to process the material, then there will be a lot of resistance.”

Cleaning water using textiles

Textiles incorporating these MOFs can also clean up dyed and polluted waters, Hinestroza says.

To make that happen, he’s bringing together the new chemistry techniques and his expertise in filtration and fiber science.

In earlier research projects, Hinestroza had created naturally fibrous materials to selectively capture or decompose harsh contaminants like dyes from textile manufacturing, arsenic from fracking, mercury and cyanide from coal mining, and insecticides and fertilizers from agricultural production.

The seed of those projects was planted while Hinestroza was traveling in his native Colombia. He noticed that large bags for packaging coffee beans were made from a strong fiber called fique. Under a microscope, the fiber revealed cavities where manganese oxide can loiter. When the fibrous cloth was placed in polluted water, the manganese oxide decomposed 99% of the indigo dye within minutes—making the water clear.

Looking for a local material that would do the same thing, Hinestroza thought to use fiber made from the peels of Cortland apple grown at Cornell Orchards and the stems of grapes sold at the Ithaca Farmers Market. Six years ago, he showed how nanorods created using those natural materials could also decompose toxins in waterways.

Bulletin Board

Gossip

JUL. 21, 2023

Hinestroza thinks the same concept, but using the MOF textiles, could help halt some of the pollution generated through textile and apparel manufacturing.

"In addition to places in Asia, I've seen Dantesque scenarios of pollution in locations like Tirappur, India, and many other locations Central America," Hinestroza says.

"I've seen the colors of the rivers run purple, green or pink," he says. "Sometimes there is truth in humor, as you can tell which colors are fashionable in New York or Paris by looking at the rivers in some of these textile mill towns."

Some fashion companies claim to be environmentally friendly on their social media channels, Hinestroza says, but the reality is quite different. "Educational institutions—like Cornell—are uniquely positioned to offer science-based solutions capable of addressing these complex problems.

"We have to proactively find answers for this business, and that is a key motivation for our research work," Hinestroza says. "The menacing problem is not only the waste generated in future textile and apparel production, but also the waste and pollution that has been already generated, which will not suddenly vanish."

Phys Org, 19 July 2023

<https://phys.org>

Scientists overcome NH₃ synthesis shortcomings

2023-07-19

To overcome these shortcomings, Nanba et al. have designed the NO-CO-H₂O reaction system. In this reaction, NO was used as the raw material and reduced to NH₃ by H₂O and toxic gases CO. The reaction equation is as follows: $\text{NO} + 2.5\text{CO} + 1.5\text{H}_2\text{O} \rightarrow \text{NH}_3 + 2.5\text{CO}_2$ ($\Delta H_{298.15\text{K}} = -414.86 \text{ kJ}\cdot\text{mol}^{-1}$)

Recently, their research found that the NO-CO-H₂O reaction can be approximately decomposed into a series reaction of WGS of CO-H₂O and reduction of NO-H₂. The results were published in the Chinese Journal of Catalysis.

When the incident photon frequency of incident light matches the vibration frequency of noble metal nanoparticles, the nanoparticles have strong absorption of photon energy and local surface plasmon resonance

Bulletin Board

Gossip

JUL. 21, 2023

(LSPR) occurs. The metal with the LSPR effect can excite high-energy hot electrons and holes, which helps to activate the reactants, thus reducing the reaction energy and increasing the reaction rate. As a rare non-noble metal with an LSPR effect, Cu has been widely used in CO hydrogenation reactions.

Cu/CeO₂ was prepared by a simple wet impregnation method and the reactivity of NO reduction to NH₃ by CO in a photothermal synergistic system was studied. As expected, high activity was obtained over Cu/CeO₂ under visible light irradiation. The LSPR effect of Cu nanoparticles can increase the NH₃ yield under mild conditions.

Recently, a research team led by Prof. Wenxin Dai from Fuzhou University, China, reported a photothermal catalytic system comprising Cu/CeO₂ that was applied to the reaction between NO, CO and H₂O for the production of NH₃ under visible-light irradiation. High NO conversion (94.4%) and NH₃ selectivity (66.5%) were achieved over Cu/CeO₂ in the presence of H₂O at 210°C. Visible light further improved the conversion of NO (97.7%) and selectivity for NH₃ (69.1%).

The quasi-situ EPR and in-situ DRIFTS results indicated that CO initially reacts with H₂O to form an HCO₃^{*} intermediate, which then decomposes into CO₂ and activated H^{*}. Finally, NO reacts with activated H^{*} to produce NH₃. The localized surface plasmon resonance effect of Cu nanoparticles induced by visible light promotes the decomposition of HCO₃^{*} to CO₂ and H^{*}, while regenerating oxygen vacancies (OVs, H₂O activation sites) at the CeO₂ sites, resulting in enhanced NH₃ production.

Phys Org, 19 July 2023

<https://phys.org>

NH₃ is not only the key chemical raw material for the industry but also a carbon-free fuel and mobile carrier of renewable energy in the future. So far, industrial NH₃ synthesis is still dominated by the traditional Haber-Bosch reaction, which requires high temperatures of 300–500 °C and pressures of 200–300 atm.

Bulletin Board

Curiosities

JUL. 21, 2023

Humans may soon grow new teeth, with promising drug trial set

2023-07-17

Now, a Japanese team of scientists is set to trial an experimental drug that would allow humans to grow completely new teeth.

A clinical trial scheduled for July 2024 will initially be for participants with tooth agenesis, a genetic condition that results in the absence of teeth, but the scientists have a view to making the treatment available for general use by as soon as 2030.

"The idea of growing new teeth is every dentist's dream," said Katsu Takahashi, lead researcher and head of the dentistry and oral surgery department at the Medical Research Institute Kitano Hospital in Osaka. "I've been working on this since I was a graduate student. I was confident I'd be able to make it happen."

In an earlier study, the researchers landed on an antibody for uterine sensitization-associated gene-1 (USAG-1), which could stimulate new tooth growth in mice with tooth agenesis.

Essentially, the scientists found that USAG-1 interacts with other proteins to suppress tooth growth. Blocking the interaction can lead to bone morphogenetic protein (BMP) signaling, which triggers new tooth growth.

Following on from those 2018 mice trials, experiments with ferrets had similar success in growing new teeth. The animals grew a seventh front tooth that was the same shape and makeup as its neighbors.

"We hope to pave the way for the medicine's clinical use," Takahashi said.

For years, scientists have been trying to crack the code on the genetic expression that enables animals such as sharks to continuously grow teeth, among other experimental research, but translating it to human application has been elusive.

The original 2021 study was published in the journal Science Advances.

New Atlas, 17 June 2023

<https://newatlas.com>

Some sharks get a new set of teeth every few weeks, while crocodiles can go through thousands of chompers in their long lifetimes. Yet the ability to endlessly replace our pearly whites is something that's eluded us and nearly all other mammals. By the time our 32 'adult' teeth grow in, that's as good as it gets.

Bulletin Board

Curiosities

JUL. 21, 2023

W.Va. Alzheimer's Association speaks on new FDA approved medication treatment

2023-07-08

The drug called Leqembi is not a cure for Alzheimer's but it can slow down the disease's progress for those with early stages of Alzheimer's Disease. Sharon Covert is the Executive Director for the West Virginia Chapter of the Alzheimer's Association.

She says full approval by the FDA is huge because now centers for Medicare and Medicaid can change how they cover the drug for patients. A full year's supply without insurance would cost \$26,500.

"On the average it delayed it at least five and a half months and it depends again on the patient and the disease and comorbidities and stuff. It (research) says it delayed cognitive decline by 5.3 months compared to a placebo after eighteen months. For some people it was more," said Covert.

Covert says Alzheimer's Disease is caused by amyloid beta that gather in the brain and disrupt nerve cell function. She says once the medication is administered through an IV it works to slow the gathering.

"It targets amyloid betas which are a big part of amyloid plaque in the brain and that is the signifier of Alzheimer's Disease as opposed to maybe frontotemporal dementia or vascular dementia," said Covert.

Covert says now that this medication is approved and for those with the early stages of Alzheimer's, it should push more people to seek help when they begin to notice symptoms.

"It's between 38 and 40 thousand people are formally diagnosed with Alzheimer's Disease in this state. So again less than half of probably what the number is. Maybe even fewer since COVID because people stopped going to the doctor so regularly during that period," said Covert.

Covert says this new drug may not be right for everyone and you should talk to your doctor about treatment options. She says some symptoms of the Alzheimer's include memory loss, difficulty completing tasks and mood changes.

New Atlas, 8 July 2023

<https://newatlas.com>

WEST VIRGINIA (WVVA) - The Food and Drug Administration has given full approval to a drug that can slow down the progression of Alzheimer's Disease. This is seen as a major breakthrough in the fight against the disease.

Bulletin Board

Curiosities

JUL. 21, 2023

Research team develops biosensor that could lead to quick and inexpensive test for osteoporosis risk

2023-07-19

Although early detection could help physicians intervene as soon as possible—when treatment might offer the greatest benefit—this type of detection is not yet possible with current osteoporosis diagnostic tests. Now, researchers reporting in ACS Central Science have developed a biosensor that could someday help identify those most at risk for osteoporosis using less than a drop of blood.

Early intervention is critical to reducing the morbidity and mortality associated with osteoporosis, a condition characterized by an elevated risk of bone fractures and which affects about 54 million people in the U.S., according to the International Osteoporosis Foundation. The most common technique used to measure changes in bone mineral density (BMD)—dual-energy X-ray absorptiometry—is not sufficiently sensitive to detect BMD loss until a significant amount of damage has already occurred.

Several genomic studies, however, have reported genetic variations known as single nucleotide polymorphisms (SNPs) that are associated with increased risk for osteoporosis. Using this information, Ciara K. O'Sullivan and colleagues wanted to develop a portable electrochemical device that would allow them to quickly detect five of these SNPs in finger-prick blood samples in a step toward early diagnosis.

The device involves an electrode array to which DNA fragments for each SNP are attached. When lysed whole blood is applied to the array, any DNA matching the SNPs binds the sequences and is amplified with recombinase polymerase that incorporates ferrocene, a label that facilitates electrochemical detection. Using this platform, the researchers detected osteoporosis-associated SNPs in 15 human blood samples, confirming their results with other methods.

As the DNA does not have to be purified from the blood, the analysis can be performed quickly (about 15 minutes) and inexpensively (less than \$0.5 per SNP). Furthermore, because the equipment and reagents are readily accessible and portable, the researchers say that the device offers great potential for use at point-of-care settings, rather than being limited to a centralized laboratory.

The technology is also versatile and can be readily adapted to detect other SNPs, as the researchers showed previously when identifying

As life expectancy increases worldwide, age-associated diseases such as osteoporosis are having an increasing impact.

Bulletin Board

Curiosities

JUL. 21, 2023

drug resistance in Tuberculosis mycobacterium from sputum and cardiomyopathy risk from blood. Although the device does not diagnose osteoporosis itself, it might help physicians identify people whom they should monitor more closely.

Phys Org, 19 July 2023

<https://phys.org>

'Stunning' discovery: Metals can heal themselves

2023-07-19

The research team from Sandia National Laboratories and Texas A&M University described their findings today in the journal Nature.

"This was absolutely stunning to watch first-hand," said Sandia materials scientist Brad Boyce.

"What we have confirmed is that metals have their own intrinsic, natural ability to heal themselves, at least in the case of fatigue damage at the nanoscale," Boyce said.

Fatigue damage is one way machines wear out and eventually break. Repeated stress or motion causes microscopic cracks to form. Over time, these cracks grow and spread until—snap! The whole device breaks, or in the scientific lingo, it fails.

The fissure Boyce and his team saw disappear was one of these tiny but consequential fractures—measured in nanometers.

"From solder joints in our electronic devices to our vehicle's engines to the bridges that we drive over, these structures often fail unpredictably due to cyclic loading that leads to crack initiation and eventual fracture," Boyce said. "When they do fail, we have to contend with replacement costs, lost time and, in some cases, even injuries or loss of life. The economic impact of these failures is measured in hundreds of billions of dollars every year for the U.S."

Although scientists have created some self-healing materials, mostly plastics, the notion of a self-healing metal has largely been the domain of science fiction.

"Cracks in metals were only ever expected to get bigger, not smaller. Even some of the basic equations we use to describe crack growth preclude the possibility of such healing processes," Boyce said.

Scientists for the first time have witnessed pieces of metal crack, then fuse back together without any human intervention, overturning fundamental scientific theories in the process. If the newly discovered phenomenon can be harnessed, it could usher in an engineering revolution—one in which self-healing engines, bridges and airplanes could reverse damage caused by wear and tear, making them safer and longer-lasting.

Bulletin Board

Curiosities

JUL. 21, 2023

Unexpected discovery confirmed by theory's originator

In 2013, Michael Demkowicz—then an assistant professor at the Massachusetts Institute of Technology's department of materials science and engineering, now a full professor at Texas A&M—began chipping away at conventional materials theory. He published a new theory, based on findings in computer simulations, that under certain conditions metal should be able to weld shut cracks formed by wear and tear.

The discovery that his theory was true came inadvertently at the Center for Integrated Nanotechnologies, a Department of Energy user facility jointly operated by Sandia and Los Alamos national laboratories.

"We certainly weren't looking for it," Boyce said.

Khalid Hattar, now an associate professor at the University of Tennessee, Knoxville, and Chris Barr, who now works for the Department of Energy's Office of Nuclear Energy, were running the experiment at Sandia when the discovery was made. They only meant to evaluate how cracks formed and spread through a nanoscale piece of platinum using a specialized electron microscope technique they had developed to repeatedly pull on the ends of the metal 200 times per second.

Surprisingly, about 40 minutes into the experiment, the damage reversed course. One end of the crack fused back together as if it was retracing its steps, leaving no trace of the former injury. Over time, the crack regrew along a different direction.

Hattar called it an "unprecedented insight."

Boyce, who was aware of the theory, shared his findings with Demkowicz.

"I was very glad to hear it, of course," Demkowicz said. The professor then recreated the experiment on a computer model, substantiating that the phenomenon witnessed at Sandia was the same one he had theorized years earlier.

Their work was supported by the Department of Energy's Office of Science, Basic Energy Sciences; the National Nuclear Security Administration and the National Science Foundation.

A lot remains unknown about the self-healing process, including whether it will become a practical tool in a manufacturing setting.

"The extent to which these findings are generalizable will likely become a subject of extensive research," Boyce said. "We show this happening in

Bulletin Board

Curiosities

JUL. 21, 2023

nanocrystalline metals in vacuum. But we don't know if this can also be induced in conventional metals in air."

Yet for all the unknowns, the discovery remains a leap forward at the frontier of materials science.

"My hope is that this finding will encourage materials researchers to consider that, under the right circumstances, materials can do things we never expected," Demkowicz said.

Phys Org, 19 July, 2023

<https://phys.org>

Scientists discover new structures for unique hybrid materials by altering their chemical bonds

2023-07-19

While it's important to understand what a structure is made from, it is just as important to understand what holds it together. Scientists and students from the University of Iowa, with the help of Sara E. Mason, a group leader in theory and computation at the Center for Functional Nanomaterials, a U.S. Department of Energy (DOE) Office of Science User Facility at DOE's Brookhaven National Laboratory, and adjunct associate professor at the University of Iowa, embarked on a quest to understand and manipulate the bonds that support the structure of uranyl tetrahalide, a uranium compound.

"This study was beyond collaborative," said study co-author Sara E. Mason. "On the synthesis side, we discovered entirely new crystal structures, which is really cool on its own. On top of that, we saw some interesting thermochemistry, the chemical energy stored in the bonds of those structures. Then there was the modeling of these structures. We could have kind of ended our study there, but Harindu Rajapaksha, the student driving this research, really wanted to push it further and use the thermochemistry and the modeling to understand these systems at a level that hasn't been possible before."

The layers of work the team contributed resulted in a comprehensive quest to understand and manipulate the bonds that support the structure of uranyl tetrahalide, an important uranium compound. The theoretical and experimental research provided insight into the way hydrogen molecules form bonds that can stabilize these complex

Putting a suite of new materials synthesis and characterization methods to the test, a team of scientists from the University of Iowa and the U.S. Department of Energy's (DOE) Brookhaven National Laboratory has developed 14 organic-inorganic hybrid materials, seven of which are entirely new. These uranium-based materials, as well as the detailed report of their bonding mechanisms, will help advance clean energy solutions, including safe nuclear energy. The work, currently published online, was recognized as both a Very Important Paper and a Hot Topic: Crystal Engineering in Angewandte Chemie

Bulletin Board

Curiosities

JUL. 21, 2023

molecular structures, paving the way for scientists to alter them for many applications.

Uranyl tetrahalide: The remix

When designing hybrid materials to study, why look at uranium? For this team, the answer is both practical and personal.

“In order to effectively manage nuclear waste, we need a better understanding of issues like material separations and recycling,” said Tori Forbes, a professor and director of the Materials Analysis, Testing, and Fabrication Facility at the University of Iowa. “We need to know how uranium behaves in solids and in water, so we are probing the most basic chemistry of uranium to acquire knowledge that can be used for advanced technologies and strategies to improve the back end of the nuclear fuel cycle.”

Looking towards a future with clean energy deployed at scale, uranium is a material that has piqued a lot of scientific interest. Uranium makes up a vast majority of the byproducts from nuclear energy, which is a zero-carbon-emission energy source. Understanding the chemistry of uranium and related systems is integral for implementing nuclear energy safely and effectively. That isn't the only intriguing aspect of this element though. Some researchers enjoy the challenge of working on such complex structures.

“I'm a chemist by training,” said Mason, “so I'm fascinated by what's really deep in the periodic table, like uranium. The deeper you go, the more electrons you have, and the more electrons you have, the weirder, more exotic, and more exciting the electronic structure and bonding is. There's this 'final frontier' of the periodic table aspect to it. These are never-before-characterized structures. These are brand new! From a pure, chemical curiosity, this is all really cool!”

This work also built on the foundation of uranyl hybrid materials research that the team published in *Inorganic Chemistry* in 2022. Both studies used density-functional theory, a computational modeling method that uses quantum mechanics to predict materials' electronic structure—the way electrons move in certain materials—alongside complementary methods to characterize these structures. In larger molecules, the atomic structure of a chemical system gets more complex, and more electrons are available to interact. Those interactions can make certain calculations difficult, which is why scientists rely on a few different methods to investigate the structure and properties of these systems. By building on the foundations

Bulletin Board

Curiosities

JUL. 21, 2023

of their previous work, the team now had enough structures to compare the theoretical work to the experiment, which limited them in the past.

Making connections

LEGO bricks will snap together and form a strong bond until they are pried apart. Their precisely molded plastic studs and recesses were designed to always work in the same way with all kinds of structures, opening a world of possibilities with each configuration. Molecules have a number of systems to bond atoms together. Some are melded to each other like glue, some click together like LEGO bricks.

Non-covalent hydrogen bonds can be thought of like an electrostatic force. There is a bond donor, like the studs on the top of a LEGO brick, that interacts with a bond acceptor, or the back of the brick where the studs fit snugly. These bonds can occur both intra- and intermolecularly, as well as between separate molecules or within the same molecule structure, which allows for all kinds of interesting molecular geometries to arise. The strength of these bonds and the energy held within the bonds change based on the structures they're in. Understanding the properties of these variations can allow scientists to get creative and discover how to take apart and rebuild useful materials in unexpected ways.

Forbes found that these bonds were more interesting than they appeared on the surface. She explained that “non-covalent interactions (NCIs) like this are often the bonds that get overlooked because they are considered weak. However, when you combine them into a larger network, then it is the sum of these interactions that can have huge impacts on the chemistry. This is more a systems-level approach to understand the chemistry holistically. These types of network systems are incredibly important to the stability of materials and the overall behavior of uranium in water.”

“NCIs are significant in several applications, including drug development and to nuclear waste reprocessing,” explained Rajapaksha. “Our goal was to create a methodology for quantitatively characterizing the NCI network in a well-studied uranyl tetrahalide model system and describe how NCIs affect two crucial uranyl solid phase properties: vibrational and formation enthalpies—a direct indicator of a species' stability. These properties are significant because vibrational spectroscopy, a method of identifying molecules by the way they absorb light, is a frequently utilized technique for specialized methods that can identify uranyl species.”

Bulletin Board

Curiosities

JUL. 21, 2023

Enthalpy is the measurement of the internal energy and pressure energy of a thermodynamic system, which determines the strength of the bonds. When broken, the energy stored in these bonds is released as heat, which can be measured through a process called calorimetry. In this process, a tool called a calorimeter measures the change in temperature that occurs when that heat is transferred out. If that word looks familiar, it's because calorimetry determines how many calories are in food. Instead of burning materials, however, the team used acid to create a chemical reaction that broke the bonds and gave off heat. Getting the computational modeling to agree with the experimental data, however, took a bit of work.

"Rajapaksha got that to work out really nicely," said Mason. "He had this high-quality agreement between the model thermochemistry and the measured thermochemistry. This is important because it means that we can rely on his measurements. Even if it's a system that hasn't been synthesized yet, he can model it correctly. He can trust those predictions. If we have a reliable way of calculating the thermochemistry, then we can spot trends and gain a new, more complete physical understanding of the bond, chemically speaking, which can allow us to tune and control these interactions."

The shape of things to come

While the team has learned some interesting things about uranyl tetrahalide systems, they say the most important finding is the cooperative methodology they have developed to characterize these materials. There are other complex chemical structures that the same principles can be applied to, and their applications could have world changing impacts.

"We are really thrilled about our findings," said Rajapaksha, "and we intend to expand this work in the future to include less-explored systems, such as neptunyl. Neptunium 237, a pollutant, is a long-lived isotope that contributes to the radioactivity of spent nuclear fuels. Basic knowledge in this field would be extremely valuable to basic sciences and nuclear waste management. We have, so far, obtained pretty intriguing results by applying our methodology to the neptunyl system, which we aim to publish soon."

Phys Org, 19 July 2023

<https://phys.org>

Bulletin Board

Curiosities

JUL. 21, 2023

Broken-down soy proteins can stop damage from excessive ice build-up and freezer burn

2023-07-19

Now, researchers reporting in the *Journal of Agricultural and Food Chemistry* have shown that broken-down soy proteins can prevent ice crystal growth and could be especially useful for preserving frozen vegan foods or biological samples.

Some animals that live in extremely cold environments, such as fish in the deep polar oceans, make antifreeze proteins to keep the liquid in their bodies from freezing. These proteins slow down ice crystal formation and growth, a process that has piqued the interest of the frozen food industry.

Recently, researchers discovered that some peptides, which are pieces of broken-down proteins, can also slow ice crystal growth. However, all of the edible peptides tested so far have come from animal sources, including fish, pigs, chickens and cows. So, Tong Wang, Madison Fomich and colleagues at the University of Tennessee wanted to see if breaking down plant proteins could generate similar compounds with ice-crystal-inhibiting properties.

The team generated peptides from a commercially available soy protein isolate powder by exposing it to three different hydrolyzing enzymes: alcalase, pancreatin and trypsin. Each resulting mixture of peptides was also separated by size into multiple fractions.

All of the mixtures slowed ice growth in tests, but the ones produced from alcalase and trypsin were better inhibitors than those from pancreatin.

For all three enzymes, most of the activity came from the fraction with the largest peptides. The large-size fractions also ended up including some smaller peptides, which on their own didn't keep ice crystals from growing; however, the team showed that these small compounds boosted the activity.

This study is an initial step toward using soy-derived peptides as a natural, effective way to reduce the ice growth that can lead to freezer burn and thereby increase the shelf life of frozen goods, including vegan and vegetarian products, the researchers say.

Phys Org, 19 July 2023

<https://phys.org>

Almost everyone has a bag of veggies shoved into the dark recesses of their freezer that's now essentially an unrecognizable block of ice crystals. And when thawed, foods damaged by excessive ice lose their texture and become mushy.

Bulletin Board

Curiosities

JUL. 21, 2023

Researchers develop NMR method for drug structure elucidation

2023-07-19

Research to determine the molecular structure of various compounds is essential for understanding biological phenomena and developing drugs to treat diseases and is mainly based on the interpretation of frequency signals measured by nuclear magnetic resonance spectroscopy (NMR).

Drs. Jinwook Cha and Jinsoo Park of the Natural Product Informatics Research Center at the Korea Advanced Institute of Science and Technology (KIST) announced that they have developed the first NMR method (ultraselective heteronuclear polarization transfer method, or UHPT) that can selectively measure the information of carbon atom nuclei linked to specific hydrogen in a single measurement. The work is published in the journal *Angewandte Chemie International Edition*.

Even with existing ultra-high field NMR equipment, only selective NMR signal measurement of specific hydrogen nuclei was possible. Still, rapid measurement of carbon nuclei signals was not possible, making it difficult to secure a satisfactory level of specific hydrogen-carbon NMR signal resolution. In addition, there were limitations in identifying the chemical structure of pharmaceutical raw materials and drugs of toxicity concern.

With the UHPT method, the researchers were able to distinguish the carbon associated with a specific hydrogen atom nucleus in a single measurement among complex carbon-carbon NMR signals, with a signal resolution of several hertz (Hz). The method enabled them to clearly analyze the structure of natural products with complex molecular structures, such as the anticancer drug dactinomycin, which is composed of optical isomers of amino acids. It also enabled the accurate assignment of the fungicide iprovercarb, a mixture of diastereoisomers.

The UHPT method is fast, accurate, and economical compared to conventional methods. When applied to NMR equipment owned by universities and companies, it has been confirmed that equivalent NMR signal resolution can be achieved in about one-fifth the measurement time of ultra-high field NMR equipment.

“The new NMR method can be used as a standard analysis technique for identifying and standardizing the active ingredients of new materials in the natural product bio industry,” said Dr. Jin-Wook Cha of KIST.

In the late 1950s and 1960s, more than 12,000 malformed babies with short arms and legs were born as a side effect of thalidomide, a drug sold to pregnant women to prevent morning sickness. The tragedy was caused by the drug’s side effect, which exists in a racemic mixture of two mirror-image forms.

Bulletin Board

Curiosities

JUL. 21, 2023

“It is expected to contribute to the development of the natural product bio industry by solving the challenges of the drug development process by using it to identify the structure of partial particulate matter, which plays a crucial role in determining the efficacy and safety of drugs.”

Phys Org, 19 July 2023

<https://phys.org>**Chemical cocktail offers “potential to reverse aging with a single pill”**

2023-07-17

The genome may contain all the genetic data needed to make an organism, but it’s not the whole picture. There’s an extra layer of information sitting on top of it called the epigenome, which instructs different cells to express specific genes vital to their function. To put it another way, the genome is like a thick instruction manual while the epigenome is the table of contents that points heart cells to the chapter relevant to their job, brain cells to their chapter, etc.

In 2006, a team of Japanese scientists discovered molecules called Yamanaka factors that reprogram the epigenome to revert adult cells back to a stem cell state. This Nobel-Prize-winning work has since fueled a flurry of research into induced pluripotent stem cells and anti-aging treatments.

The Harvard Medical School team previously used gene therapy to deliver Yamanaka factors into mice, which effectively “reboots” the epigenome and reverses aging symptoms. However, gene therapy can be expensive and tricky to administer to patients, so in the new study the researchers screened for chemicals that might work the same way.

They set up systems of cell samples exposed to different chemicals and monitored them for specific protein signals that indicated the health of the cells, distinguishing between youthful, old and senescent (or inactive) cells. In doing so, the team identified six chemical cocktails that appeared to restore the cells to more youthful states. Better yet, this aging reversal took place in under a week.

“Until recently, the best we could do was slow aging. New discoveries suggest we can now reverse it,” said David Sinclair, lead scientist on the study. “This process has previously required gene therapy, limiting its widespread use.”

Most of us begrudgingly accept aging as a part of life – but maybe we don’t have to. A new study led by scientists at Harvard Medical School has identified chemical cocktails that can restore cells to a more youthful state, paving the way for aging-reversal treatments that are more accessible than gene therapy.

Bulletin Board

Curiosities

JUL. 21, 2023

The researchers say that this kind of epigenetic treatment could not only reverse aging, but prevent or treat common diseases such as cancer, Alzheimer's, diabetes and cardiovascular disease.

"This new discovery offers the potential to reverse aging with a single pill, with applications ranging from improving eyesight to effectively treating numerous age-related diseases," said Sinclair.

The research was published in the journal *Aging*.

New Atlas, 17 July 2023

<https://newatlas.com>

J&J subsidiary sues more talc researchers

2023-07-18

US healthcare giant Johnson & Johnson (J&J) has launched a second lawsuit against researchers whose studies have connected talc-based powders and cancer, attacking the underlying science.

Earlier this month, J&J's subsidiary LTL Management, which was formed in 2021 to assume the company's liabilities in talc litigation, sued two pathologists affiliated with Peninsula Pathology Associates in Virginia, US – Theresa Emory and John Maddox – and Richard Kradin, a pathologist and pulmonologist who is now retired from the Harvard University-affiliated Massachusetts General Hospital Cancer Center.

The article that the three jointly published in 2020 concluded that mesothelioma can develop following exposures to cosmetic talcum powders, but LTL argues that the paper included false statements, including that cosmetic talc was the only known exposure of the 75 study subjects to asbestos. The company asserts that some individuals in that study had admitted to, and even made claims seeking compensation for, contact with other sources of asbestos. 'The authors knew that, or recklessly disregarded substantial evidence to the contrary,' LTL's complaint states.

The company is seeking monetary damages, including punitive damages, for fraud and other legal infractions, as well as retraction or public correction of the article.

This case sits alongside an ongoing lawsuit by LTL making similar claims about a separate 2019 study led by Jacqueline Moline. All four of these

Lawsuit claims another study linking talc use to cancer is fraudulent

Bulletin Board

Curiosities

JUL. 21, 2023

researchers had provided expert testimony against J&J in court, and their studies were cited in lawsuits against J&J.

Mark Lanier, an attorney who represented 22 women in a successful 2018 talc lawsuit against J&J, is not surprised by LTL's latest action. 'This is an old tactic of J&J trying to squash scientific opinion through intimidation using its behemoth status,' he tells *Chemistry World*. 'This was done in the 1970s when scientists tried to warn about J&J's talc containing asbestos,' Lanier continues. 'I think this shows a level of audacity, if not desperation.'

Jean Eggen, a professor emerita of law at Widener University in Delaware, US, agrees. 'There is no doubt that these are aggressive tactics by LTL,' she says. 'If such cases were to succeed, it would leave virtually every expert open to claims of fraud whenever the opposing experts disagree or find fault with their opinions,' Eggen warns. 'This would have a chilling effect on expert testimony in toxic tort litigation.'

Companies like J&J have much greater resources than university scientists, emphasises Marion Nestle, a professor emerita of nutrition, food studies and public health at New York University. 'J&J has much deeper pockets than any academic researcher – their incomes aren't even in the same stratosphere – so if it can break them financially, it will,' she warns. 'Doing so will also send a message to other academics that criticising drug companies will have unpleasant consequences.'

Chemistry World, 18 July 2023

<https://chemistryworld.com>

Revolutionising RSV prevention

2023-07-12

It has been several decades since the monoclonal antibody Synagis (palivizumab) was approved as a preventative for severe disease caused by respiratory syncytial virus (RSV) infection.

But it seems possible that, by the end of the summer, there will be three brand new therapies – including two vaccines and a long-acting antibody – approved for the prevention of RSV lower respiratory tract disease in Europe and the US.

The arrival of multiple new therapies all at once is not a coincidence, but the product of decades of fundamental scientific research to understand the structure of the virus' fusion protein; a surface protein that locks on to host cells, fusing the viral envelope with the host cell membrane.

New vaccines and a long-acting antibody aim to protect older adults and babies from respiratory syncytial virus

Bulletin Board

Curiosities

JUL. 21, 2023

'[It has been] accelerated by some very basic research in fundamental virology, immunology and protein folding, which has led to an understanding of what it is that is protective, and how immune responses are induced by the pre-fusion configuration of the viral fusion protein,' explains Peter Openshaw, a professor of experimental medicine at Imperial College London. '[This] has led to stabilised pre-fusion vaccines, which induce a much more effective neutralising antibody than the degraded, post-fusion, flipped form of the protein,' he adds.

Several big hitters including Pfizer, GSK, Moderna and Johnson & Johnson (J&J) have been working on vaccines to protect the over 60s against the potentially fatal virus.

Pfizer and GSK are racing ahead. GSK's vaccine candidate, Arexvy, was approved for over 60s by the US Food and Drug Administration (FDA) in early May 2023, the European Medicine's Agency (EMA) in June, and UK's Medicines and Healthcare Products Regulatory Agency (MHRA) in July. The FDA approved Pfizer's vaccine, Abrysvo, for the same cohort in late May 2023 (at the time of writing the EMA was still reviewing this vaccine).

In January, Moderna released promising phase 3 results from a trial of its mRNA-based vaccine in people aged 60 and over. The company has now begun submissions for regulatory approval in the US, EU, Switzerland and Australia.

Meanwhile, in March, J&J shelved development of its adenovirus-vectored vaccine after an assessment of the 'RSV vaccine landscape', despite positive results from its phase 2 trial in adults aged 65 years and over.

Doubts around maternal vaccination

Trials of RSV vaccines for pregnant mothers have produced more complex results. Vaccinating during pregnancy generates high levels of maternal antibodies, which transfer through the placenta into the foetus, protecting babies through the first few months after birth.

Both Pfizer and GSK are developing versions of their vaccines for pregnant mothers. However, in February 2022, GSK voluntarily stopped its phase 3 'Grace' trial as well as two other maternal vaccination trials. This was after data from the phase 3 trial showed a higher proportion of preterm births in the treatment group, compared to the control group.

Although the overall incidence of preterm birth remained low in both groups, and below the preterm birth background rates for most of the

Bulletin Board

Curiosities

JUL. 21, 2023

participating countries, this 'observed imbalance' was deemed statistically significant.

The data also showed a higher number of deaths occurring in the first 28 days after birth in the treatment group compared to the control group. It was concluded that this was a consequence of the imbalance in preterm births and not a separate safety signal.

'We are still investigating the cause of the safety signal and, currently, do not have a mechanistic explanation for it,' a GSK spokesperson told Chemistry World.

'The preterm birth imbalance was not observed in any other clinical trial investigating the RSV maternal vaccine. Since voluntarily stopping the enrollment and vaccinations in the RSV maternal trials, GSK has regularly updated regulatory authorities, investigators, ethics committees and the independent data monitoring committee about the safety signals and findings from analyses and investigations, and will continue to do so,' the spokesperson added.

'Study participants were updated and informed throughout the course of the trial via investigators. A follow-on study to monitor subsequent pregnancies has been initiated.' Further data are expected in the coming months as safety follow-up studies are ongoing.

'It's a real puzzle,' says Openshaw, who has studied RSV for many years. 'It's hard to imagine what happened – was there some [other] factor operating in particular locations, because it wasn't in all the locations in which the study was being done [the preterm imbalance was greatest in low- and middle-income countries], and it also appeared to be confined to a particular period. Was this an interaction with some other environmental factor or the administration of some other vaccines in addition, or was there some co-infection happening?'

'It's so important that we have all the information to try and work out what it was, that might have led to the safety signal,' he adds. 'I think it's very important that the data are carefully examined, and that specific monitoring is performed in any future stage.'

The interim trial data from Pfizer's maternal vaccine, published in April 2023, did not identify any safety concerns. However, due to the similarities between the vaccines, experts have urged for further analysis of the trial data to be carried out.

Similar, but different

Bulletin Board

Curiosities

JUL. 21, 2023

The Pfizer and GSK vaccines are based on 'very similar technologies; along the lines of conventional protein-based vaccines', Openshaw tells Chemistry World.

The Pfizer vaccine is bivalent, containing stabilised forms of the pre-fusion conformation of the F-protein from both RSV-A and RSV-B virus subtypes. GSK's vaccine is also based on a stabilised pre-fusion F-protein. The formulation for older adults also includes an adjuvant (AS01E, derived from saponins from the Chilean Soapbark tree) to boost the immune response. Its maternal vaccine does not contain the adjuvant.

Pfizer maintains that its external data monitoring committee did not see any statistical difference in the number of adverse events of prematurity between those immunised with the vaccine candidate or the placebo. 'Our overall analysis demonstrating there is no statistical difference in premature births was submitted to the US Food and Drug Administration' a Pfizer spokesperson told Chemistry World.

The FDA's advisory committee met on 18 May 2023 to review Pfizer's maternal immunisation safety and efficacy data. While committee members were in positive agreement on the efficacy data, they were split when it came to the safety data, with four out of 14 voting that the data were not adequate to support safety. These recommendations will now be taken into consideration by the FDA with a decision expected by August 2023.

Another option for infants

Openshaw says that the current lack of understanding around the mechanisms behind the GSK safety signal is a 'definite setback' to maternal vaccination against RSV.

'[The vaccine works by] inducing antibodies in the mum,' he explains. After 36 weeks into pregnancy, these antibodies can transfer to the foetus across the placenta, but premature babies born before that point wouldn't get the same protection, he points out. The mother's antibodies can also transfer in breast milk, protecting babies after birth.

However, he highlights that AstraZeneca and Sanofi's Beyfortus (nirsevimab), a long-acting antibody treatment which also targets the pre-fusion form of the RSV fusion glycoprotein, is a more direct way to protect babies, even those born prematurely or who aren't being breastfed.

A significant benefit of nirsevimab, compared to the older pavilizumab, is that only a single intramuscular injection is required to protect infants

Bulletin Board

Curiosities

JUL. 21, 2023

for the entire RSV season. With pavilizumab, children have to be given monthly doses during the RSV season.

Europe was the first to grant approval for the use of nirsevimab in infants in November 2022, closely following by the UK. The US FDA approved the antibody in mid July 2023.

However, there is the important issue of resistance to consider. 'If nirsevimab were rolled out on a population scale, there would be pressure put on the virus to evolve mutations which are nirsevimab-resistant,' says Openshaw. 'I think there's space for other antibodies to be used, alone or in combination,' he adds. 'It's a developing field.'

The road to developing a new preventative against RSV has seen its fair share of bumps, and the future of a maternal vaccine is still yet to be determined. However, with the recent flurry of approvals, patients may not have to wait much longer to access the new therapies. And not a moment too soon.

At the end of 2022, the European Centre for Disease Prevention and Control said more countries were reporting an increasing number of paediatric hospitalisations and rising pressure in healthcare facilities due to RSV co-circulating with other respiratory viruses, such as flu and Covid-19, suggesting that these new tools will be invaluable.

Chemistry World, 12 July 2023

<https://chemisrtyworld.com>

Bulletin Board

Technical Notes

JUL. 21, 2023

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

CHEMICAL EFFECTS

[Neurotoxicity of microplastics: a CiteSpace-based review and emerging trends study](#)

[The impact of solvents on the toxicity of the banned parathion insecticide](#)

[Emerging aspects of metal ions-doped zinc oxide photocatalysts in degradation of organic dyes and pharmaceutical pollutants - A review](#)

ENVIRONMENTAL RESEARCH

[An environmentally friendly approach for industrial wastewater treatment and bio-adsorption of heavy metals using Pistacia soft shell \(PSS\) through flocculation-adsorption process](#)

[integrated environmental health assessment: proposed approaches to exposure during chemical incidents](#)

PHARMACEUTICAL/TOXICOLOGY

[Drug approval prediction based on the discrepancy in gene perturbation effects between cells and humans](#)

[Per- and polyfluoroalkyl substances in ambient fine particulate matter in the Pearl River Delta, China: Levels, distribution and health implications](#)

OCCUPATIONAL

[Prenatal Exposure to Nitrate in Drinking Water and Adverse Health Outcomes in the Offspring: a Review of Current Epidemiological Research](#)

[Novel Insights into the Dermal Bioaccessibility and Human Exposure to Brominated Flame Retardant Additives in Microplastics](#)

[Association of oral health with various work problems: a cross-sectional study of Japanese workers](#)