

Bulletin Board

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

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ASIA PACIFIC

INSIGHT: Companies need to be aware of China's tightening control of polluting chemical

2022-06-27

Legislation to control the use of polluting and hazardous chemicals is under scrutiny worldwide as the number of new substances on the market rises and research points to new areas of concern.

In the EU, the outcome of a review of the Reach chemicals registration and authorisation regulatory system will drive that agenda for the chemical industry for one or two decades, a senior industry executive has highlighted.

In the US, the industry and regulators are at odds on tightening chemicals control with the sector calling for stable, cost-effective policies in the face of severe delays in approving new chemicals under the Toxic Substance Control Act (TSCA).

A recent petition has called for greenhouse gases (GHG) to be regulated under the TSCA, which would be a major step in implementing a widespread polluter-pays principle.

And, in the world's largest market for chemicals by far, China, the use of chemicals that are harmful to human health and to the environment will be controlled more effectively, lawyers have noted, with widespread consequences.

China issued an action plan on controlling new pollutants on 24 May: it requires inspection and monitoring to identify new high-risk pollutants, according to a release from the State Council.

Under the current five-year plan, special action will be taken against a batch of polluting chemicals with screening of high concern and "high-yield" chemicals to be completed by 2025.

Laws and management systems on chemical-related environmental issues "will be gradually established and improved", a release from the Council in English said at the time.

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ICIS, 27-06-22

<https://www.icis.com/explore/resources/news/2022/06/27/10779109/insight-companies-need-to-be-aware-of-china-s-tightening-control-of-polluting-chemicals/>

Australian Industrial Chemicals Introduction Scheme Notice of completed evaluations - 30 June 2022

2022-06-30

We have published 28 evaluations about the human health and environmental risks associated with the use of certain chemicals on the Australian Inventory of Industrial Chemicals (Inventory).

These evaluations are issued by the AICIS Executive Director under section 78 of the Industrial Chemicals Act 2019 and are listed below. The draft versions of these evaluation statements were open for public consultation that closed on 17 June 2022.

Read More

AICIS, 30-06-22

<https://www.industrialchemicals.gov.au/news-and-notices/notice-completed-evaluations-30-june-2022>

AMERICA

PFAS Update: PFAS Regulation Under the NPDES Program

2022-06-27

To date, businesses have only had to contend with a handful of state laws and regulations limiting the concentration of per- and polyfluoroalkyl substances ("PFAS") in industrial wastewater discharges.

However, on April 28, 2022, EPA issued a guidance memorandum explaining that "EPA will use the NPDES program to restrict PFAS discharges to water bodies. For federally-issued permits, EPA will include requirements to monitor for PFAS, include requirements to use best management practices like product substitution and good housekeeping practices, and establish practices to address PFAS-containing firefighting

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foams in storm water." The new memorandum supersedes a November 2020 EPA interim memorandum addressing similar issues, and it reaffirms EPA's commitment to regulate PFAS compounds as outlined in the PFAS Strategic Roadmap.

All of which means that businesses with National Pollutant Discharge Elimination System ("NPDES") permits need to understand the new guidance, and evaluate whether PFAS discharges in wastewater are relevant to their business.

I. What is EPA Actually Requiring?

The April 28, 2022 Memorandum includes three significant requirements for all EPA-issued NPDES permits for facilities where PFAS substances are expected or likely to be present in their discharge:

- Effluent Monitoring. Permits should include a requirement that facilities use the draft analytical method 1633 to test for the 40 PFAS compounds detectable under that method.
- Monitoring Frequency. Sampling should be conducted quarterly, and all PFAS monitoring data must be reported on Discharge Monitoring Reports.

Read More

JD Supra, 27-06-22

<https://www.jdsupra.com/legalnews/pfas-update-pfas-regulation-under-the-9016874/>

PFAS Regulations Could Open Floodgates to Prop 65 Enforcement – Assess & Manage Your Exposure Now

2022-06-27

The group of chemicals known as PFAS (per- and poly-fluoroalkyl substances) are high on the federal regulatory agenda for 2022, as implementation of EPA's "PFAS Strategic Roadmap" proceeds. One potential consequence will be new additions to California's "Prop 65 List" of chemicals known to cause cancer or reproductive harm. Already, two PFAS substances are subject to Prop 65 warning and labeling requirements (PFOA and PFOS), with a third (PFNA) subject to enforcement starting in 2023. New federal Health Advisory Levels (HALs) announced on June 15, 2022 may provide the basis to add another two PFAS to the list (PFBS and GenX).

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Prop 65 requires certain warnings at the time of sale and labeling of products containing chemicals that have been identified as posing a potential risk of reproductive harm or cancer, and provides for private enforcement actions. Manufacturers, importers, suppliers, distributors, and retailers of products for sale in California are all potentially liable for ensuring adequate consumer warnings. Prop 65 also requires employers and property owners to provide warnings in workplaces and in buildings where exposure to listed chemicals may occur. The penalty for failure to provide such warnings can be as high as \$2,500 per violation (e.g., per sale for consumer products; per day for workplace/building exposure).

Because of the ubiquity of PFAS and the very low levels at which they are regulated — typically measured in parts per trillion — these and any future listings have far-reaching implications for businesses.

[Read More](#)

National Law Review, 27-06-22

<https://www.natlawreview.com/article/pfas-regulations-could-open-floodgates-to-prop-65-enforcement-assess-manage-your>

State Polluter-Pays Bills Aim to Make Companies Cover PFAS Harms

2022-06-27

Emily Donovan calls fighting chemical pollution her “passion project,” an issue that crept onto her radar through a youth program she directs at her North Carolina church.

“It just struck me odd that half of the students in the program were praying for a parent or family member with a really serious and severe medical problem,” Donovan said. “I don’t remember that growing up.”

In 2017, local news reported that GenX—a chemical that the Chemours Co. used in manufacturing—was flowing from Fayetteville down through North Carolina’s Cape Fear River, polluting it and local drinking water. GenX is one of more than 9,000 per- and polyfluoroalkyl substances, or PFAS, a chemical class linked to human health issues like higher risk of cancer.

Donovan co-founded Clean Cape Fear, a group among advocates pushing for a polluter-pays bill to make companies cover cleanup, monitoring, and filtration costs and limit contamination upstream.

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But that bill and similar measures in other states aren’t advancing. Industry groups have pushed back, arguing that polluter-pay bills would bring over-regulation and economic costs.

Advocates for these kinds of bills say their success in Vermont could be a model for other states. A new law signed by the governor in April in the Green Mountain State includes a liability test and gives residents the right to sue chemical companies for medical monitoring costs if they claim they’ve been exposed to PFAS or other chemicals.

[Read More](#)

<https://news.bloomberglaw.com/environment-and-energy/state-polluter-pays-bills-aim-to-make-companies-cover-pfas-harms>

Supreme Court’s next major ruling could severely limit the power of the EPA

2022-06-28

The shock waves from the Supreme Court’s decision to overturn *Roe v. Wade* last Friday are spreading across the country, but at least one more major opinion is still looming. And while it may not affect personal liberties as much as earlier rulings this term, it still could have a dramatic impact on people’s lives.

West Virginia v. the Environmental Protection Agency has the potential to sharply curtail the power of the EPA.

The case is an unusual one for the court. Instead of looking at a rule that has already been established, this one will set a precedent for future actions, specifically those tied to the EPA’s authority to regulate power plant emissions. Should the court rule against the EPA, that could hamper the Biden administration’s plans to combat climate change, as regulating authority could shift to Congress.

A survey by think-tank Data for Progress found 60% of voters believe the EPA should be allowed to regulate air pollution. But this court has not paid a lot of attention to popular opinion this term.

The case started last year, when a federal court ruling left open the possibility that policies putting caps on greenhouse gas emissions from power plants could be allowed. While there have been no moves to do

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that, a collection of Republican attorneys general and coal companies banded together to appeal the ruling.

Read More

Fortune, 28-06-22

<https://fortune.com/2022/06/27/supreme-court-epa-ruling-ramifications-2022/>

Illinois passes PFAS incineration ban

2022-06-29

A new Illinois law has made it illegal to incinerate per- and polyfluoroalkyl substances, better known as PFAS, within the state. The bill, HB 3190, was signed by Gov. J.B. Pritzker June 8 and is designed to address concerns from environmental justice communities who are often exposed to the consequences of industrial pollution.

The recently passed law is an updated version of a similar bill presented to Pritzker in August 2021. The previous bill was swiftly vetoed due to its definition of "incineration," with the governor stating in a letter that the term was "overly broad" and would prevent waste management companies from using other pollution control devices, including thermal oxidation.

According to Pritzker, the bill's prior terminology would further result in a substantial increase in emissions of greenhouse gases, PFAS, fluorides, hazardous air pollutants, volatile organic materials and carbon monoxide.

The new legislation will now allow for incineration by thermal oxidizer when operated as a pollution control device, with some exemptions for medical waste.

Supporters of the bill, including the Illinois chapter of the Sierra Club and the community group United Congregations of Metro East, have expressed that the legislation stems from community concerns regarding an incineration plant in Sauget, Illinois, run by Veolia Environmental Services.

Read More

Waste Today, 29-06-22

<https://www.wastetodaymagazine.com/article/illinois-passes-pfas-incineration-ban/>

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EUROPE

The Mediterranean is in danger as the planet heats up

2022-06-30

Today, the Mediterranean basin is a hotspot of climate change.

The region is warming 20% faster than the rest of the world, and 250 million of its inhabitants will be living under severe water stress by 2040. Meanwhile, the intensity and frequency of extreme weather events continue to increase, and a third of the region's population the coastal population will be affected by sea level rise in the coming decades. Faced with an intensifying triple crisis on climate, biodiversity and water, it is clear that bold action is needed to reverse the impacts that are already afflicting the region and its people, including loss of ecosystem services and land, crop failure, water pollution and mortality from heat – all of which will increasingly jeopardize social, economic and political stability as they worsen.

In this context, the new nature restoration law of the European Union's Green Deal agenda offers the perfect opportunity to galvanize regional action. However, in its current form, published by the European Commission last week, it simply does not go far enough to reflect the urgency of the challenges facing the Mediterranean – in particular, when it comes to prioritizing our wetlands, which can offer unique solutions to all three crises.

Read More

The Bharatexpress, 30-06-22

<https://www.thebharatexpressnews.com/the-mediterranean-is-in-danger-as-the-planet-heats-up/>

European teenagers are high – on PFAS

2022-06-30

Teenagers in Europe have high levels of PFAS in their blood, especially Swedish, French and Norwegian ones, an EU human biomonitoring study shows. The reason for these high levels? A large intake of egg, fish, animal intestines – and locally produced food.

PFAS are ubiquitous and can be found in nearly all living humans, including young children and teenagers. According to a large-scale human biomonitoring study, HBM4EU, PFAS has been found in the blood of

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teenagers in all nine of the examined European countries. Over 14 percent of the samples exceeded the health guidelines from the European Food and Safety Authority, EFSA.

One out of the nine countries meet the health recommendation

Many different chemicals have been assessed in a wide range of age groups within the HBM4EU project. When it comes to teenagers and PFAS specifically, samples were collected from 2,000 teenagers between the ages of 12 and 18, in nine countries between 2014 and 2021: Norway, Sweden, Slovakia, Slovenia, Greece, Spain, Germany, France, and Belgium.

Out of these countries, Sweden's teenagers had the highest levels of PFAS in their blood: 12.31 micrograms per liter. French teenagers took second place with 11.26 micrograms per liter, and Norway placed third, with 10.83 micrograms per liter.

Only in one of the examined countries did teenagers have lower levels of PFAS in their blood than the EFSA health recommendation of 6.9 micrograms per liter: Spain, with 5.09 micrograms per liter.

Locally produced food largest influencing factor

Dr. Maria Uhl is a toxicologist at Umweltbundesamt Laboratories at the Environment Agency in Austria. Within the HBM4EU project, she has been Chemical Group Lead for PFAS.

"We found a couple of determinants when it comes to what affects the levels of PFAS in teenagers. Those were a higher consumption of fish, egg, and offal [animal entrails and intestines, editor's note], and also locally produced food", she says.

Read More

Chemsec, 30-06-22

<https://chemsec.org/european-teenagers-are-high-on-pfas/>

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INTERNATIONAL

Detailed review finds stronger links between adverse health effects and traffic pollution

2022-06-27

A comprehensive new scientific review released today by the Health Effects Institute (HEI) found growing confidence in the links between several adverse health effects and traffic related air pollution (TRAP). The review, the largest of its type to date, was conducted by a panel of thirteen renowned experts who evaluated 353 published scientific reports on traffic pollution and related health effects between 1980 and 2019.

Following HEI's widely cited 2010 TRAP report, HEI appointed a new panel in 2018 to evaluate evidence of long-term exposure to TRAP and selected adverse health outcomes. The panel found a high level of confidence that strong connections exist between TRAP and early death due to cardiovascular diseases. A strong link was also found between TRAP and lung cancer mortality, asthma onset in children and adults, and acute lower respiratory infections in children. Of the studies reviewed, 118 examined respiratory effects in children and included populations residing in a wide range of countries, with a majority based in Europe and North America.

"Traffic pollution clearly remains an important public health concern across the globe," said Hanna Boogaard, HEI Consulting Principal Scientist and member of the review panel. "This report provides the evidence to inform policymaker actions to mitigate the consequences of traffic pollution."

Many higher-income countries around the world have seen tailpipe emissions and ambient concentrations of some air pollutants drop steadily over the past several decades, and air quality regulations and improvements in vehicular emission-control technologies which contributed to these decreases will continue. However, those improvements do not fully offset the growth and increased congestion of the world's motor vehicles due to population growth, urbanization, and economic activity, especially in low- and middle-income countries. Older higher emitting vehicles also remain on the roads of many of those poorer countries. The introduction of new technologies such as electric vehicles promises reductions of some components of TRAP, especially if the electric grid is decarbonized.

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JUL. 08, 2022

Read More

Phys Org, 27-06-22

<https://phys.org/news/2022-06-stronger-links-adverse-health-effects.html>

Regulations on health and safety to be strengthened

2022-06-25

Rules governing occupational safety and health will soon be put in place to ensure compliance with the Safety and Health at Work (SHaW) Act, Minister of Labour, Social Security and the Third Sector Colin Jordan has revealed.

With Parliament set to pass amendments to the SHaW Act in a matter of days, Jordan said this is to be followed shortly by necessary regulations that are to be put into force once the Bill clears the Senate.

“The Safety and Health at Work Act which we call SHaW, has been in place for a number of years, but the regulations have not been in place and the labour department has placed quite a lot of emphasis on making sure that we have regulations to address matters like sanitary conveniences, water, PPE (personal protective equipment) and a whole range of actions detailing how those actions are to be done, how the facilities are to be set out and how workers are to be dealt with in terms of the broader framework of the Safety and Health at Work Act.

“So once the Bill passes the Senate then that will come into force and the regulations will also come into force. There will be outstanding, one regulation, which depends on the passage of the Bill that is currently before the House and that, is the right to refuse dangerous tasks,” he said.

Read More

Barbados Today, 25-06-22

<https://barbadostoday.bb/2022/06/25/regulations-on-health-and-safety-to-be-strengthened/>

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REACH Update

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Dr Sharon McGuinness selected as ECHA's new Executive Director

22-06-22

The Management Board of the European Chemicals Agency has selected Dr Sharon McGuinness as ECHA's next Executive Director.

Helsinki, 22 June 2022 – As part of the appointment procedure, she will make a statement before the European Parliament and answer questions from its members. This is tentatively scheduled for 4 July 2022.

Paul Krajnik, Chair of ECHA's Management Board says: “Congratulations to Sharon - we have selected an excellent candidate and look forward to hearing the European Parliament's views. The new Executive Director will play an instrumental role for the Agency, which enters a crucial time in its work, marked by the EU's ambitious objectives under the Chemicals Strategy for Sustainability.”

Dr Sharon McGuinness, an Irish national, is the Chief Executive Officer of the Health and Safety Authority (HSA) in Ireland since 2018. Prior to this, she was the Assistant Chief Executive for the Chemicals and Prevention Division within the Authority, with responsibility for division management, policy provision, advice and enforcement for a wide range of occupational health and safety, chemical and market surveillance legislation aimed at protecting human health and safety for workers and consumers.

She was a member of ECHA's Management Board between 2014-2020 and Chair of the Board between 2016-2020. She graduated from the University College Dublin with a B.Sc. (Hons) in pharmacology and chemistry, and she holds a PhD in pharmacology, as well as diplomas in Legal Studies and Company Direction.

Dr McGuinness was one of the candidates preselected by the European Commission after an open competition and interviewed by the Management Board for the post.

Her selection follows that of Bjorn Hansen who retired in March 2022. Since 1 April 2022, Shay O'Malley has been ECHA's acting Executive Director.

Her selection follows that of Bjorn Hansen who retired in March 2022. Since 1 April 2022, Shay O'Malley has been ECHA's acting Executive Director.

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ECHA, 22-06-22

<https://echa.europa.eu/es/-/dr-sharon-mcguinness-selected-as-echa-s-new-executive-director>

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Janet's Corner

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Types of Scopes

2022-07-08

	REGULAR SCOPE	ELECTRON SCOPE	RADIO SCOPE
MICRO	LOOK AT SMALL STUFF	LOOK AT REALLY SMALL STUFF	FIGURE OUT WHY YOUR RADIO BROKE
TELE	LOOK AT STUFF THAT'S FAR AWAY	DETECT COSMIC RAYS	LOOK AT DISTANT HIGH-ENERGY STUFF
PERI	LOOK FOR ENEMY SHIPS	EXAMINE THE HULL OF AN ENEMY SHIP FOR STRUCTURAL FLAWS	LET THE CREW OF YOUR SUBMARINE LISTEN TO NPR
STETHO	LISTEN TO A PATIENT'S CHEST	BURN A PATIENT'S SKIN	PLAY THE NOISES FROM A PATIENT'S CHEST ON NPR
KALEIDO	SEE COOL SHAPES AND COLORS	SEE COOL BREMSSTRAHLUNG	ANOTHER WORD FOR THE "SCAN" BUTTON
GYRO	BALANCE BY SPINNING	ANOTHER WORD FOR ELECTROMAGNET	ANOTHER WORD FOR TURNTABLE
HORO	GET RANDOM LIFE ADVICE	PREDICT A PARTICLE'S QUANTUM STATE	GET RANDOM LIFE ADVICE FROM EXPLODING GALAXIES

<https://xkcd.com/2627/>

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Hazard Alert

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Acrylic Acid

2022-07-08

Acrylic acid (IUPAC: prop-2-enoic acid) is an organic compound with the formula $\text{CH}_2=\text{CHCO}_2\text{H}$. It is the simplest unsaturated carboxylic acid, consisting of a vinyl group connected directly to a carboxylic acid terminus. This colourless liquid has a characteristic acrid or tart smell. [1] It is miscible with water, alcohol, ether, benzene, chloroform, and acetone. It polymerises readily in the presence of oxygen. Exothermic polymerisation at room temperature may cause acrylic acid to become explosive if confined. It is sensitive to heat and sunlight. It is also a fire hazard when exposed to heat or flame. Acrylic acid is incompatible with strong oxidisers, strong bases, strong alkalies and pure nitrogen. It may polymerise (sometimes explosively) on contact with amines, ammonia, oleum and chlorosulfonic acid, iron salts and peroxides. It may corrode iron and steel. [2]

USES [2]

The primary use of acrylic acid is in the production of acrylic esters and resins, which are used primarily in coatings and adhesives. It is also used in oil treatment chemicals, detergent intermediates, water treatment chemicals, and water absorbent polyacrylic acid polymers. Acrylic acid is used widely for polymerisation, including production of polyacrylates. It is a monomer for polyacrylic and polymethacrylic acids and other acrylic polymers. It is used in the manufacture of plastics, as a tackifier, as a flocculant, in the production of water-soluble resins and salts, as a comonomer in acrylic emulsion and solution polymers and in moulding powder for signs, construction units, decorative emblems and insignias. It is used in polymer solutions for coatings applications, in paint formulations, in leather finishings, in paper coatings, in polishes and adhesives and in general finishes and binders.

SOURCES OF EMISSION & ROUTES OF EXPOSURE

Sources of Emission [2]

- Industry sources: Acrylic acid may be released in wastewater and as emissions during its production and use. Acrylic acid is emitted from the production of acrylic acid and acrylate. The primary stationary sources listed in the US are manufacturers of guided missiles and space vehicles, and electronic components and accessories.

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- Diffuse sources: Acrylic acid emissions can occur from polishes, paints, coatings, rug backings, adhesives, plastics, textiles, and paper finishes. Acrylic acid has been used as a pesticide.
- Natural sources: Acrylic acid is also produced naturally by some species of algae and has been found in the rumen fluid of sheep.
- Transport sources: None.
- Consumer products: Products containing acrylic acid include polishes, paints, coatings, rug backings, adhesives, plastics, textiles, and paper.

Routes of Exposure [3]

Exposure can occur through inhalation, ingestion, and contact to the eyes and skin. Studies show that eye or skin irritation from exposure to acrylic acid can range in intensity from mild to severe. People can be exposed to acrylic acid through direct contact with a product containing it or by inhaling it in air contaminated by a nearby plant manufacturing acrylic acid. Exposure to acrylic acid occurs primarily in the workplace via inhalation and dermal contact during its manufacture or use. Consumers may be exposed to acrylic acid in polishes, paints, coatings, rug backings, adhesives, plastics, textiles, and paper finishes. In addition, acrylic acid may be released in wastewater and as emissions during its production and use. Individuals may be exposed by inhaling ambient air or ingesting contaminated water. Acrylic acid is also produced naturally by some species of algae.

HEALTH EFFECTS [4]

Acute Effects

- Acrylic acid is a strong irritant to the skin, eyes, and mucous membranes in humans. The liquid may cause blindness if splashed into the eye.
- Acute (short-term) exposure of rats to acrylic acid by inhalation has been observed to produce nose and eye irritation, lung haemorrhage, and degenerative changes in the liver and kidneys.
- Tests involving acute exposure of rats, mice, and rabbits have demonstrated acrylic acid to have moderate acute toxicity by inhalation or ingestion, and high acute toxicity by dermal exposure.

Chronic Effects

- Information on the chronic (long-term) effects of acrylic acid in humans is not available.

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- In mice and rats chronically exposed to acrylic acid by inhalation, lesions of the nasal mucosa were observed.
- Reduced body weights and altered organ weights were observed in rats orally exposed to acrylic acid.
- The Reference Concentration (RfC) for acrylic acid is 0.001 milligrams per cubic metre (mg/m³) based on degeneration of the nasal olfactory epithelium in mice.
- The Reference Dose (RfD) for acrylic acid is 0.5 milligrams per kilogram body weight per day (mg/kg/d) based on reduced pup weights in rats.

Reproductive/Developmental Effects

- No information is available on the reproductive or developmental effects of acrylic acid in humans.
- Decreased body weight gain and decreased fertility were reported in one study of rats exposed to acrylic acid by ingestion, although the decrease in fertility was not statistically significant compared with the control.
- Embryotoxic and teratogenic effects (birth defects) were observed in rats injected with acrylic acid.

Cancer Risk

- No information is available on the carcinogenic effects of acrylic acid in humans.
- In one study, squamous cell carcinomas of the skin were reported in mice treated topically with acrylic acid. Other animal studies have not reported carcinogenic effects.
- EPA has not classified acrylic acid for carcinogenicity.

SAFETY [5]

Fist Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.
- Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

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- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Handling & Storage

- Keep locked up;
- Keep container dry;
- Keep away from heat;
- Keep away from sources of ignition;
- Ground all equipment containing material;
- Do not ingest or breathe gas/fumes/ vapour/spray;
- Never add water to this product.
- Keep away from incompatibles such as oxidising agents, acids, alkalis, moisture.
- Store in a segregated and approved area;
- Keep container in a cool, well-ventilated area;
- Keep container tightly closed and sealed until ready for use.

Exposure Controls & Personal Protection

Engineering Controls

- Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.

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- Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protective Equipment

The following personal protective equipment is recommended when handling acrylic acid:

- Face shield;
- Full suit;
- Vapour respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves;
- Boots

Personal Protection in Case of a Large Spill:

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

REGULATION [3,6]

United States

ACGIH: The American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for acrylic acid of 2 ppm, 5.9 mg/m³ TWA ; Skin; Appendix A4, Not Classifiable as a Human Carcinogen

NIOSH: The National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for acrylic acid of 2 ppm, 6 mg/m³ TWA; Skin

Australia

Safe Work Australia recommends an 8 hour time weighted average (TWA) exposure limit for acrylic acid of 2 ppm (5.9 mg/m³)

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REFERENCES

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Zero-emissions hydrogen cargo airship prototype planned for 2025

2022-06-23

H2 Clipper presents a very compelling case to bring back an extremely controversial technology, saying that large electric airships lifted and powered by green hydrogen stand ready to transport massive cargo loads over enormous distances much faster than cargo ships, opening up inland logistics facilities with minimal ground infrastructure, and doing it all with zero emissions.

We're talking cargo loads up to 340,000 lb (150,000 kg – or the equivalent of about 115 Toyota Corollas), distances up to 6,000 miles (9,650 km, or roughly the distance between Los Angeles and Barcelona), at cruising speeds over 175 mph (280 km/h, or a little under one-third the speed of a Dreamliner passenger plane – but 7-10 times faster than a cargo ship can go).

That's an incredibly compelling set of numbers, particularly given the cost; H2 Clipper claims it'll cost a quarter of what today's air freight services cost per ton-mile, making it an economically disruptive way to move bulk cargo as well as an opportunity to decarbonize trans-continental logistics operations.

Hydrogen airships have a bit of a reputation, of course, thanks to the tragic and compelling footage of the Hindenburg disaster in 1937. But as we discussed when we first profiled H2 Clipper's technology, there are many reasons why people may have taken the wrong message away from that incident, including some pretty heinous skullduggery from helium lobbyists.

As momentum gathers behind hydrogen as a next-generation clean aviation fuel, there's a compelling case to question why it can't also be used as a cheap, green lift gas as well, to open up these kinds of clean cargo transport possibilities with minimal, if any, risk to human life.

In 2021, H2 Clipper was accepted into Dassault Systems' 3D Experience lab accelerator program, giving this small company the ability to use cutting-edge simulation and development tools to refine its design. The company has completed simulated wind tunnel tests using computational fluid dynamics (CFD), validating its super-low drag aerodynamics and putting some weight behind the company's fuel burn and operational cost estimations.

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At this stage, the company plans to get a prototype built by 2025, and to have a full-sized hydrogen airship flying in 2028. It's still a risky play for investors; the FAA currently bans hydrogen as a lift gas. But green hydrogen projects worth billions of dollars are springing up across the globe, so hydrogen itself stands to have a lobby group behind it like it's never had before.

In that context, one interesting use case for hydrogen airships is to move green hydrogen itself; H2 Clipper says that these aircraft will beat rail, trucks, ships and even pipelines on price for hydrogen exports moving any distance over 1,000 miles (1,600 km). These "pipelines in the sky" will also be as green as the bulk hydrogen they're shifting, adding a further benefit that green H2 exporters might be willing to take some risks betting on.

New Atlas, 23 June 2022

<https://newatlas.com>

Discovery of mechanical itch protein hints at new treatments for eczema

2022-06-26

Scientists investigating the cellular basis for itching have made an important discovery, and one that could lead to new treatments of chronic conditions like eczema. The breakthrough centers on what's known as mechanical itching, with the research team behind it demonstrating how a protein can be blocked to alleviate itching sensation in mouse models of the condition.

Much of the itching that we experience as humans is driven by activation of the histamine system. This system releases histamine as part of the body's reaction to things like mosquito bites, pollen or certain medications, and creates the type of itchiness and redness we often see as a result of those triggers. While this form of "chemical itching" has been studied at great length, recently scientists have begun to shift their focus to a separate phenomenon known as "mechanical itching."

Mechanical itching is created through the application of light stimuli, such as an insect crawling across your skin or a woolen blanket being dragged across your bare knees. In the context of a condition like eczema, mechanical stimulation through scratching can exacerbate inflammation and in turn the itching, creating a vicious circle of irritation. Scientists have begun to make inroads into possible interventions in this space, such as a

In the context of a condition like eczema, mechanical stimulation through scratching can exacerbate inflammation and in turn the itching, creating a vicious circle of irritation.

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2019 study that identified a neuronal pathway responsible for regulating mechanical itch.

This latest study, carried out by scientists at Scripps Research, has now identified a protein in sensory nerves that works as a type of “sensor” for mechanical itch. This is the first discovery of a mechanical itch protein, and stems from earlier work concerning an ion channel protein PIEZO1 in the outer membrane of cells, which opens up in response to mechanical distortion.

Studies have begun to suggest that PIEZO1 is expressed at low levels in certain subsets of sensory neurons, and the Scripps Research team has shed important new light on this idea. Through experiments on mice, the team showed that PIEZO1 acts as a pressure-sensitive ion channel protein in two types of sensory neurons, which were already known to play a role in chemical itch.

Mice with overactive forms of PIEZO1 were found to be much more sensitive to mechanical itch sensations, while mice lacking the protein scratched themselves much less in response. The scientists were then able to show that using a compound to block PIEZO1 reduced scratching behaviors in mouse models of eczema.

“We did see a dramatic effect on itch with this compound, and though it wasn’t specific enough against PIEZO1 to develop into a drug, we hope eventually to develop a much more PIEZO1-specific compound for treating itch conditions,” said first author of the study Rose Hill.

There does appear to be some overlap between chemical and mechanical itching so far as PIEZO1 is concerned. The scientists report that they also saw reductions and increases in scratching due to chemical itch triggers when turning PIEZO1 activity up and down, albeit on a smaller scale. This does suggest, however, that mechanical and chemical itch signals share some of the same neuronal pathways.

More work is needed to translate the findings into a clinical treatment for conditions like eczema, but the findings do deepen our understanding of itching in the meantime. As part of their next steps, the scientists are now investigating the potential relationship between variations in the PIEZO1 gene and itch sensitivity in humans.

“These findings help us untangle the complexity of itch sensation, and suggest that PIEZO1 inhibitors could be very useful clinically,” says study senior author Ardem Patapoutian.

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The research was published in the journal Nature.

New Atlas, 26 June 2022

<https://newatlas.com>

Octopus brain and human brain share the same ‘jumping genes’

2022-06-24

The octopus is an exceptional organism with an extremely complex brain and cognitive abilities that are unique among invertebrates. So much so that in some ways it has more in common with vertebrates than with invertebrates. The neural and cognitive complexity of these animals could originate from a molecular analogy with the human brain, as discovered by a research paper recently published in BMC Biology and coordinated by Remo Sanges from SISSA of Trieste and by Graziano Fiorito from Stazione Zoologica Anton Dohrn of Naples.

The research shows that the same “jumping genes” are active both in the human brain and in the brain of two species, *Octopus vulgaris*, the common octopus, and *Octopus bimaculoides*, the Californian octopus. This discovery could help us understand the secret of the intelligence of these fascinating organisms.

Sequencing the human genome revealed as early as 2001 that over 45% of it is composed of sequences called transposons, so-called “jumping genes” that, through molecular copy-and-paste or cut-and-paste mechanisms, can “move” from one point to another of an individual’s genome, shuffling or duplicating. In most cases, these mobile elements remain silent: they have no visible effects and have lost their ability to move. Some are inactive because they have, over generations, accumulated mutations; others are intact, but blocked by cellular defense mechanisms. From an evolutionary point of view, even these fragments and broken copies of transposons can still be useful, as “raw matter” that evolution can sculpt.

Among these mobile elements, the most relevant are those belonging to the so-called LINE (Long Interspersed Nuclear Elements) family, found in a hundred copies in the human genome and still potentially active. It has been traditionally thought that LINEs’ activity was just a vestige of the past, a remnant of the evolutionary processes that involved these mobile elements, but in recent years new evidence emerged showing that their activity is finely regulated in the brain. There are many scientists who believe that LINE transposons are associated with cognitive abilities such

“Jumping genes”, through molecular copy-and-paste or cut-and-paste mechanisms, can “move” from one point to another of an individual’s genome, shuffling or duplicating.

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as learning and memory: they are particularly active in the hippocampus, the most important structure of our brain for the neural control of learning processes.

The octopus' genome, like ours, is rich in "jumping genes," most of which are inactive. Focusing on the transposons still capable of copy-and-paste, the researchers identified an element of the LINE family in parts of the brain crucial for the cognitive abilities of these animals. The discovery, the result of the collaboration between Scuola Internazionale Superiore di Studi Avanzati, Stazione Zoologica Anton Dohrn and Istituto Italiano di Tecnologia, was made possible thanks to next generation sequencing techniques, which were used to analyze the molecular composition of the genes active in the nervous system of the octopus.

"The discovery of an element of the LINE family, active in the brain of the two octopuses species, is very significant because it adds support to the idea that these elements have a specific function that goes beyond copy-and-paste," explains Remo Sanges, director of the Computational Genomics laboratory at SISSA, who started working at this project when he was a researcher at Stazione Zoologica Anton Dohrn of Naples. The study, published in BMC Biology, was carried out by an international team with more than twenty researchers from all over the world.

"I literally jumped on the chair when, under the microscope, I saw a very strong signal of activity of this element in the vertical lobe, the structure of the brain which in the octopus is the seat of learning and cognitive abilities, just like the hippocampus in humans," tells Giovanna Ponte from Stazione Zoologica Anton Dohrn.

According to Giuseppe Petrosino from Stazione Zoologica Anton Dohrn and Stefano Gustinich from Istituto Italiano di Tecnologia, "This similarity between man and octopus that shows the activity of a LINE element in the seat of cognitive abilities could be explained as a fascinating example of convergent evolution, a phenomenon for which, in two genetically distant species, the same molecular process develops independently, in response to similar needs."

"The brain of the octopus is functionally analogous in many of its characteristics to that of mammals," says Graziano Fiorito, director of the Department of Biology and Evolution of Marine Organisms of the Stazione Zoologica Anton Dohrn. "For this reason, also, the identified LINE

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element represents a very interesting candidate to study to improve our knowledge on the evolution of intelligence."

Phys Org, 24 June 2022

<https://phys.org>

Plant-based plastic strong as PET, degrades into sugars in the environment

2022-06-27

Plastics are tough and versatile materials, which is great when they're in use but not so good when they end up in the environment. Scientists at EPFL have now developed a new PET-like plastic material derived from waste plant matter that can be chemically recycled or degrade into harmless sugars in the environment.

The new material gets its plastic-comparable strength from lignin, a biopolymer that makes up the hard wall of plant cells. In previous work, the EPFL team developed a method for cooking non-edible plant material like wood and bark in inexpensive chemicals, which extracts lignin and keeps it stable to produce a plastic precursor material. In the new study, the researchers used a different but related chemical to make a more versatile bioplastic.

"By using a different aldehyde – glyoxylic acid instead of formaldehyde – we could simply clip 'sticky' groups onto both sides of the sugar molecules, which then allows them to act as plastic building blocks," said Lorenz Manker, first author of the study. "By using this simple technique, we are able to convert up to 25 percent of the weight of agricultural waste, or 95 percent of purified sugar, into plastic."

The resulting bioplastic showed many of the desirable properties of conventional plastics. It can withstand temperatures of up to 100 °C (212 °F), has tensile strengths of up to 77 MPa, a stiffness of up to 2,500 MPa, and formed strong barriers to oxygen and water vapor. It's versatile too, with the team demonstrating that it can be used to make packaging film, filaments for 3D printing, or fibers that can be spun into textiles.

The material's environmental friendliness isn't limited to its creation – its disposal is green too. It can be chemically recycled using the process currently used to recycle PET plastics, and if it does make it into the environment, it will degrade into its constituent plant sugars rather than microplastics.

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There are plenty of plant-based bioplastics in development, with major corporations like Lego and Coca-Cola already trialing them in their ubiquitous products. As with all of these advances, there are still hurdles to overcome before they could be scaled up to mass production, but in this case, the team says that the chemistry to make the new bioplastic is simpler than others, and use chemicals that are inexpensive and already in wide use.

“The plastic has very exciting properties, notably for applications like food packaging,” said Jeremy Luterbacher, lead author of the study. “And what makes the plastic unique is the presence of the intact sugar structure. This makes it incredibly easy to make because you don’t have to modify what nature gives you, and simple to degrade because it can go back to a molecule that is already abundant in nature.”

The research was published in the journal Nature Chemistry.

New Atlas, 27 June 2022

<https://newatlas.com>

AI Used to Assess Integrity of Embryos for IVF

2022-06-29

An AI algorithm was used in a global study to assess the genetic integrity of embryos through images alone. The algorithm was able to identify, most of the time, whether an embryo was genetically normal, or ‘euploid,’ meaning it has the normal human complement of 46 chromosomes. The findings were published in Human Reproduction this month.

Presagen’s Life Whisperer Genetics process is non-invasive, low-cost, and provides instant results. PGT-A, the standard method currently used to evaluate embryos for IVF, requires a potentially risky biopsy of the embryo, followed by an expensive and time-consuming genetic testing procedure. While the Life Whisperer technology is not as accurate as PGT-A, it can be used to prescreen embryos.

The study was conducted with IVF clinics including, Ovation Fertility (USA), IVF-Life (Europe), Alpha IVF & Women’s Specialists (SE Asia), and Wings IVF (India). These clinics provided approximately 15,000 blastocyst-stage embryo images with results of PGT-A. A total of 5050 of these images were of embryos on day five of in vitro culture, and these were used for the AI model development. The images were made using static two-dimensional optical light microscopy.

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Overall accuracy for the prediction of euploidy on a blind test dataset was 65.3%, with a sensitivity of 74.6%. When the blind test dataset was cleansed of poor quality and mislabeled images, overall accuracy increased to 77.4%.

Presagen’s chief medical science officer Sonya Diakiw explained “Because this assessment is based on images alone, it is not as accurate as PGT-A itself, which involves actual DNA sequencing. But we are finding that PGT-A results themselves can be variable, as they depend on the embryo sample being tested. PGT-A only tests 5 cells from a total of around 200, so it is not always representative of the entire embryo. Life Whisperer Genetics is a whole-embryo assessment of genetic integrity that does not require any invasive procedures, which can be used to prioritize embryos for use in IVF procedures.”

The technology was evaluated prospectively on patients in Europe in collaboration with the IVF-Life Group. Jon Aizpurua from IVF-Life said “Life Whisperer Genetics can be used for patients as a pre-screen, to ensure we only genetically test embryos that are likely to be normal, saving patients time and money. For patients who are not comfortable with invasive genetic tests, or in countries like Germany where invasive genetic tests are not permitted, Life Whisperer Genetics is a viable alternative to help select embryos that are most likely to be euploid.”

Prospective studies were also performed in collaboration with Alpha IVF & Women’s Specialists in Malaysia. Chief Embryologist Adelle Yun Xin Lim said “Computer vision with AI may revolutionize IVF treatment and this new technique is another milestone of AI in IVF. The technique will help doctors and embryologists around the world to predict the chromosome status of embryos in a rapid and non-invasive manner enabling the prioritization of embryos that are likely to be euploid for transfer or for further confirmatory PGT testing, leading to a faster time to pregnancy and reducing the cost of the treatment.”

Life Whisperer Genetics is already available for IVF clinics and their patients in over 40 countries globally. It can be used in combination with Life Whisperer Viability, which assesses if an embryo is likely to lead to a pregnancy. International clinical studies have shown that Life Whisperer Viability can perform better than embryologists’ current manual embryo assessment methods.

Inside Precision Medicine, 29 June 2022

<https://insideprecisionmedicine.com>

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Dream of unlimited, clean nuclear fusion energy within reach

2022-06-28

The old joke is that nuclear fusion is always 30 years away. Yet the dream of abundant clean energy is no laughing matter as we meet an ITER researcher to catch up on progress at the reactor facility.

The sun has fueled life on Earth for billions of years, creating light and heat through nuclear fusion. Given that incredible power and longevity, it seems there can hardly be a better way to generate energy than by harnessing the same nuclear processes that occur in our own and other stars.

Nuclear fusion reactors aim to replicate this process by fusing hydrogen atoms to create helium, releasing energy in the form of heat. Sustaining this at scale has the potential to produce a safe, clean, almost inexhaustible power source.

The quest began decades ago, but could a long-running joke that nuclear fusion is always 30 years away soon start to look old?

Some hope so, following a major breakthrough during a nuclear-fusion experiment in late 2021. This came at the Joint European Torus (JET) research facility in Oxfordshire, U.K., in a giant, doughnut-shaped machine called a tokamak.

Inside, superheated gases called plasmas are generated in which the fusion reactions take place, containing charged particles that are held in place by powerful magnetic fields. Such plasmas can reach temperatures of 150 million degrees Celsius, an unfathomable 10 times hotter than the sun's core.

In a sustained five-second burst, researchers in the EUROfusion consortium released a record-breaking 59 megajoules (MJ) of fusion energy. This was almost triple the previous 21.7 MJ record set at the same facility in 1997, with the results touted as "the clearest demonstration in a quarter of a century of the potential for fusion energy to deliver safe and sustainable low-carbon energy."

The results provided a major boost ahead of the next phase of nuclear fusion's development. A larger and more advanced version of JET known as ITER (meaning "the way" in Latin) is under construction on a 180-hectare site in Saint-Paul-lès-Durance, southern France.

The old joke is that nuclear fusion is always 30 years away. Yet the dream of abundant clean energy is no laughing matter.

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ITER, which is being built as a collaboration between 35 nations, including those in the EU, is aimed at further firming up the concept of fusion. One of the most complicated machines ever to be created, it was scheduled to start generating its first plasma in 2025 before entering into high-power operation around 2035—although researchers on the project expect some delays because of the pandemic.

Major milestone

The results at JET represent a major landmark, said Professor Tony Donné, program manager of the EUROfusion project, a major consortium of 4,800 experts, students and facilities across Europe. "It's a huge milestone—the biggest for a long time," he said.

"It's confirmed all the modeling, so it has really increased confidence that ITER will work and do what it's meant to do." While the energy generated at JET lasted just a few seconds, the aim is to ramp this up to a sustained reaction that produces energy.

The results were the culmination of years of preparation, with Prof Donné explaining that one of the key developments since 1997 involved changing the inner wall of the JET vessel.

Previously, the wall was made of carbon, but this proved too reactive with the fuel mix of deuterium and tritium, two heavier isotopes—or variants—of hydrogen used in the fusion reaction. This resulted in the formation of hydrocarbons, locking up the tritium fuel in the wall.

In the rebuild, which involved 16,000 components and 4,000 tons of metal, the carbon was replaced with beryllium and tungsten to reduce tritium retention. Ultimately, the team was able to cut the amount of trapped fuel by a large multiple, contributing to the success of the recent fusion shot.

DEMO run

In preparation for the next stage of fusion's epic journey, upgrades to JET ensured that its configuration aligns with the plans for ITER. Further in the future, the next step beyond ITER will be a demonstration power plant known as DEMO, designed to send electricity into the grid—leading on to fusion plants becoming a commercial and industrial reality.

"ITER is a device which will create 10 times more fusion energy than the energy delivered to the plasma," said Prof Donné. "But as it is an experimental facility, it will not deliver electricity to the grid. For that, we

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need another device, which we call DEMO. This will really bring us to the foundations for the first generation of fusion power plants.”

Prof Donné added: “JET has shown now that fusion is plausible. ITER has to show that it’s further feasible, and DEMO will need to demonstrate that it really works.”

Planned to provide up to 500 megawatts (MW) to the grid, he thinks it is realistic for DEMO to come into operation around 2050. “We hope to build DEMO much faster than we built ITER, making (use of the) lessons learned,” he said.

Yet there are other key challenges to overcome on the way to getting nuclear fusion up and running. Not least is that while deuterium is abundant in seawater, tritium is extremely scarce and difficult to produce.

The researchers therefore plan to develop a way of generating it inside the tokamak, using a “breeding blanket” containing lithium. The idea is that high-energy neutrons from the fusion reactions will interact with the lithium to create tritium.

Essential energy

Prof Donné said nuclear fusion could prove a pivotal green and sustainable energy source for the future. “I would say it’s essential,” he said. “I’m not convinced that by 2050 we can make the carbon dioxide transition with only renewables, and we need other things.”

And although he says the current method of creating nuclear energy through fission is becoming safer and safer, fusion has key advantages. Proponents for ITER talk of benefits such as an absence of meltdown risk, adding that nuclear fusion does not produce long-lived radioactive waste and that reactor materials can be recycled or reused within 100 to 300 years.

“It’s definitely much safer,” said Prof Donné. Referencing the stigma carried by nuclear energy, he said, “What we see when we interact with the public is that people very often haven’t heard about nuclear fusion. But when we explain the pros and cons, then I think people get positive.”

Referring to Lev Artsimovich, dubbed the “father of the tokamak,” he said, “Artsimovich always said fusion will be there when society really needs it.

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If we get fusion up and running, then really we have a very safe and clean energy source which can give us energy for thousands of years.”

Phys Org, 28 June 2022

<https://phys.org>

Report estimates 10% of all cancers in Europe are caused by pollution

2022-06-28

A new report from the European Environmental Agency estimates more than 10 percent of all cancer cases in Europe are likely caused by environmental and occupational exposure to pollution. The report indicates most of these cases could be prevented by improving environmental protections.

The new findings gather data from a number of previously published studies. It is initially estimated that 40 percent of all cancer cases in Europe are related to modifiable risk factors, the majority of which are lifestyle-related: smoking, diet, alcohol etc. However, about one quarter of these cases – amounting to 10 percent of overall cancer cases in Europe – can be attributed to environmental pollutants.

The report breaks these pollutants down into five categories: air pollution, radon and UV radiation, second-hand smoke, asbestos, and chemicals.

Both indoor and outdoor air pollution is linked to two percent of all cancer deaths in Europe. In particular, air pollution is estimated to account for seven percent of all lung cancers. Air pollution in this context encompasses fine particulate matter (PM 2.5 particles) and exposure to pollutants such as nitrogen dioxide (NO₂) and sulphur dioxide (SO₂).

UV radiation, primary from the sun causing skin cancers, is thought to account for nearly four percent of all cancer cases in Europe. Radon radiation, on the other hand, is a little more rare, coming from natural granite sources in the ground. Mining causes high occupational exposures to radon radiation, while some ground and lower floor dwellings can expose individuals to higher than average levels.

Second-hand smoke and asbestos are both well-known sources of carcinogens, and both have been the subject of much regulation in recent years. The new report suggests due to the long timeframe from exposure to cancer diagnosis, there are still new cases appearing relating to historic exposures but these rates will hopefully reduce over the coming years.

A report indicates many cancer cases can be avoided if exposure to carcinogenic pollutants is minimized

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Exposure to chemical carcinogens is perhaps the least clear category discussed in the new report. It is suggested occupational exposure to chemicals is a big problem in Europe but incredibly challenging to quantify. Some of the listed chemicals in the report range from acrylamide, benzophenones, flame retardants, perfluoroalkyl and polyfluoroalkyl substances (PFAS) and pesticides, to benzene, formaldehyde and silica dust.

“While we have estimates for some substances, we are not certain about the overall contribution of chemical carcinogens to the burden of cancer in Europeans,” the report states. “Many chemicals on the market and in the environment have not undergone exhaustive carcinogenicity testing, and significant knowledge gaps remain on the potential carcinogenic effects of low levels of exposure to combinations of chemicals throughout our lifetime.”

The report outlines a number of interventions that can be implemented to try and reduce exposure from these cancer-causing pollutants. Most of these interventions are directed at policy-makers as the report makes clear it is difficult for individuals to avoid these exposures if they are not stopped by governments at a regulatory level.

“Environmental and occupational cancer risks are inherently preventable, and reducing them is key to reducing the burden of cancer in Europe,” the report concludes. “Moreover, people have limited scope for protecting themselves from most environmental and occupational determinants of cancer, making regulatory intervention and policy implementation especially necessary and relevant. Policy and regulations need to be underpinned by sufficient resources allocated to preventing exposure (including occupational) and reducing pollution.”

Source: European Environment Agency

New Atlas, 28 June 2022

<https://newatlas.com>

Ancient wolves give clues to origins of dogs

2022-06-29

Where and when dogs arose is one of the biggest mysteries of domestication. To solve it, researchers have tried everything from analyzing ancient dog bones to sequencing modern dog DNA—all with inconclusive results. Now, researchers have tried a new tack: figuring out where the ancient wolves that gave rise to dogs lived. The new study

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doesn't close the case, but it does point to a broad geographic region—eastern Eurasia—while also suggesting our canine pals may have been domesticated more than once.

That region “certainly jibes with what I’ve been thinking,” says Adam Boyko, a canine geneticist at Cornell University who wasn’t involved in the work. He remains skeptical, however, about the possibility of separate domestication events.

At least 15,000 years ago—and perhaps closer to 23,000 years ago—humans and wolves began their fateful dance toward domestication. This was during the last ice age, when high-latitude regions experienced a bitterly cold, dry climate. According to the most prominent theory, less timid gray wolves inched closer and closer to human campsites to get scraps. Over time, they passed along genes for increasingly docile behaviors and traits. Humans found these newfound friends useful for hunting and guarding campsites.

Exactly where this happened is hotly contested. Some genetic analyses of modern dogs suggest they arose in East Asia, whereas other genetic and archaeological evidence indicates our pups came from Siberia, the Middle East, Western Europe, or perhaps multiple places. “There’s been a lot of pins put in the map,” says Pontus Skoglund, a geneticist at the Francis Crick Institute and senior author of the new study.

Skoglund and a vast cast of collaborators from 16 countries decided to try something new: build a massive map of wolf ancestry around the time of domestication. “If you imagine wolf ancestry as a big jigsaw puzzle, we placed the dog puzzle piece within that map,” he says.

The paper’s 81 co-authors—mostly archaeologists, anthropologists, and geneticists—pooled their collective resources and sequenced 66 ancient wolf genomes and incorporated six previously published ones, from sites across Europe, Siberia, and North America. The ages of these animals spanned the past 100,000 years. Next, the team used computer software to compare the 72 ancient genomes and work out a rough family tree.

One of the first things that jumped out was how interconnected these far-flung wolf populations remained over time, Skoglund says. Over tens of thousands of years, wolves living as far apart as Alaska and Europe continued to share recent ancestry, suggesting the animals were mobile and mated at least occasionally.

Study helps narrow down where our canine pals came from

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Comparing the ancient wolf genomes with those from modern and ancient dogs, the researchers found that dogs are much more closely related to ancient wolves from eastern Asia than those from Europe. That points to eastern Eurasia as their home region and more or less eliminates western Eurasia as a potential origin spot, the team contends today in *Nature*. But none of the ancient wolves proved to be a close ancestor of dogs, meaning the actual site of domestication remains a mystery. The paper also resolves the mystery of whether an 18,000-year-old pup found in 2019 near the Siberian city of Yakutsk was a wolf or a dog. The answer? Wolf.

These are “exciting results,” says evolutionary biologist Yohey Terai at Japan’s Graduate University for Advanced Studies, whose work previously identified an extinct Japanese wolf as the closest relative of modern dogs yet found. Even though “the authors did not sample a wolf population most closely related to dogs,” he says, “these samples help narrow down the place of origin.”

Curiously, the ancient wolves from Europe do appear to share some genes with modern dogs from western Eurasia and Africa, such as basenjis and various village dogs. That suggests that at some point, European wolves either interbred with a western population of dogs or, more intriguingly, underwent a separate domestication event.

Boyko isn’t convinced, noting that the later interbreeding scenario is the simplest. “I think their evidence makes the case even stronger that we’re looking at a single domestication event,” he says, though one that may have been complicated by interbreeding and other factors.

The ancient wolf genomes also provide a lengthy look at which genes proliferated through the species over the course of approximately 30,000 generations. One gene known to be involved in craniofacial development swept through wolves beginning about 40,000 years ago. Within the span of 10,000 years, it went from being incredibly rare to present in 100% of ancient wolves. It’s still found in modern wolves and dogs today. Another cluster of genes related to olfaction experienced a similar sweep between 45,000 and 25,000 years ago.

Together, Skoglund notes, these events suggest wolves evolved adaptations—perhaps stronger jaws and more sensitive noses—that

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allowed them to survive the harsh conditions of the ice age. “The better to eat you with,” he says, “the better to smell you with.”

Science, 29 June 2022

<https://science.org>

Found: The ‘holy grail of catalysis’—turning methane into methanol under ambient conditions using light

2022-06-30

An international team of researchers, led by scientists at the University of Manchester, has developed a fast and economical method of converting methane, or natural gas, into liquid methanol at ambient temperature and pressure. The method takes place under continuous flow over a photocatalytic material using visible light to drive the conversion.

To help observe how the process works and how selective it is, the researchers used neutron scattering at the VISION instrument at Oak Ridge National Laboratory’s Spallation Neutron Source.

The method involves a continuous flow of methane/oxygen-saturated water over a novel metal-organic framework (MOF) catalyst. The MOF is porous and contains different components that each have a role in absorbing light, transferring electrons and activating and bringing together methane and oxygen. The liquid methanol is easily extracted from the water. Such a process has commonly been considered “a holy grail of catalysis” and is an area of focus for research supported by the U.S. Department of Energy. Details of the team’s findings, titled “Direct photo-oxidation of methane to methanol over a mono-iron hydroxyl site,” are published in *Nature Materials*.

Naturally occurring methane is an abundant and valuable fuel, used for ovens, furnaces, water heaters, kilns, automobiles and turbines. However, methane can also be dangerous due to the difficulty of extracting, transporting and storing it.

Methane gas is also harmful to the environment when it is released or leaks into the atmosphere, where it is a potent greenhouse gas. Leading sources of atmospheric methane include fossil fuel production and use, rotting or burning biomass such as forest fires, agricultural waste products, landfills and melting permafrost.

Methanol is a more versatile carbon source than methane and is a readily transportable liquid. It can be used to make thousands of products such as solvents, antifreeze and acrylic plastics.

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Excess methane is commonly burned off, or flared, to reduce its environmental impact. However, this combustion process produces carbon dioxide, which itself is a greenhouse gas.

Industry has long sought an economical and efficient way to convert methane into methanol, a highly marketable and versatile feedstock used to make a variety of consumer and industrial products. This would not only help reduce methane emissions, but it would also provide an economic incentive to do so.

Methanol is a more versatile carbon source than methane and is a readily transportable liquid. It can be used to make thousands of products such as solvents, antifreeze and acrylic plastics; synthetic fabrics and fibers; adhesives, paint and plywood; and chemical agents used in pharmaceuticals and agrichemicals. The conversion of methane into a high-value fuel such as methanol is also becoming more attractive as petroleum reserves dwindle.

Breaking the bond

A primary challenge of converting methane (CH₄) to methanol (CH₃OH) has been the difficulty of weakening or breaking the carbon-hydrogen (C-H) chemical bond in order to insert an oxygen (O) atom to form a C-OH bond. Conventional methane conversion methods typically involve two stages, steam reforming followed by syngas oxidation, which are energy intensive, costly and inefficient as they require high temperatures and pressures.

The fast and economical methane-to-methanol process developed by the research team uses a multicomponent MOF material and visible light to drive the conversion. A flow of CH₄ and O₂ saturated water is passed through a layer of the MOF granules while exposed to the light. The MOF contains different designed components that are located and held in fixed positions within the porous superstructure. They work together to absorb light to generate electrons which are passed to oxygen and methane within the pores to form methanol.

“To greatly simplify the process, when methane gas is exposed to the functional MOF material containing mono-iron-hydroxyl sites, the activated oxygen molecules and energy from the light promote the activation of the C-H bond in methane to form methanol,” said Sihai Yang, a professor of chemistry at Manchester and corresponding author. “The process is 100% selective—meaning there is no undesirable by-product—

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comparable with methane monooxygenase, which is the enzyme in nature for this process.”

The experiments demonstrated that the solid catalyst can be isolated, washed, dried and reused for at least 10 cycles, or approximately 200 hours of reaction time, without any loss of performance.

The new photocatalytic process is analogous to how plants convert light energy to chemical energy during photosynthesis. Plants absorb sunlight and carbon dioxide through their leaves. A photocatalytic process then converts these elements into sugars, oxygen and water vapor.

“This process has been termed the ‘holy grail of catalysis.’ Instead of burning methane, it may now be possible to convert the gas directly to methanol, a high-value chemical that can be used to produce biofuels, solvents, pesticides and fuel additives for vehicles,” said Martin Schröder, vice president and dean of faculty of science and engineering at Manchester and corresponding author. “This new MOF material may also be capable of facilitating other types of chemical reactions by serving as a sort of test tube in which we can combine different substances to see how they react.”

Using neutrons to picture the process

“Using neutron scattering to take ‘pictures’ at the VISION instrument initially confirmed the strong interactions between CH₄ and the mono-iron-hydroxyl sites in the MOF that weaken the C-H bonds,” said Yongqiang Cheng, instrument scientist at the ORNL Neutron Sciences Directorate.

“VISION is a high-throughput neutron vibrational spectrometer optimized to provide information about molecular structure, chemical bonding and intermolecular interactions,” said Anibal “Timmy” Ramirez Cuesta, who leads the Chemical Spectroscopy Group at SNS. “Methane molecules produce strong and characteristic neutron scattering signals from their rotation and vibration, which are also sensitive to the local environment. This enables us to reveal unambiguously the bond-weakening interactions between CH₄ and the MOF with advanced neutron spectroscopy techniques.”

Fast, economical and reusable

By eliminating the need for high temperatures or pressures, and using the energy from sunlight to drive the photo-oxidation process, the new conversion method could substantially lower equipment and operating costs. The higher speed of the process and its ability to convert

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methane to methanol with no undesirable byproducts will facilitate the development of in-line processing that minimizes costs.

Phys Org, 30 June 2022

<https://phys.org>

Welcome to the 'Pandemicene'

2022-06-26

What causes pandemics?

Nearly all of them start with animal-to-human transmission of a virus or bacteria to which people have no immunity. Animal pathogens are the source of about 60 percent of known infectious diseases and 75 percent of those that appear for the first time in humans. About 250 known diseases have made the leap from animals to humans, but a 2020 United Nations report estimates that as many as 850,000 viruses lurk within the bodies of mammals and birds. Zoonotic diseases have wreaked havoc throughout human history. The bubonic plague, which wiped out up to 60 percent of the population of Europe, Asia, the Middle East, and North Africa in the 14th century, was caused by the *Y. pestis* bacteria transmitted from rodents via fleas. The 1918 flu pandemic, which killed an estimated 50 million people, is believed to have originated in poultry and wild birds. "Spillover" events appear to be getting more common. HIV and Ebola can be traced back to primates in Africa; the original SARS virus is believed to have jumped from bats to humans by way of a mammal called a civet. COVID is caused by a bat virus, SARS-CoV-2, that recent research has found most likely spilled over from animals sold at a wet market in Wuhan, China, in 2019, although some believe Chinese scientists modified the virus and accidentally let it escape.

Why are animal viruses so dangerous?

Most viruses that infect animals can't harm us because they lack the ability to bind to human cells. Occasionally, though, one manages to attach and penetrate human cells, replicate, and evolve. This occurs before the immune system recognizes the invader as a threat and makes antibodies and T and B cells to ward off the virus. For animal pathogens to infect humans, direct contact is not necessary: They can also travel through contaminated food, water, surfaces, or via a parasitic vector such as a flea or mosquito. Some animals are more prolific vessels and spreaders of disease. Over 10 percent of rodent species host pathogens that can possibly infect people. Apes, monkeys, and other primates — our closest

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relatives in the wild — carry 77 known zoonotic viruses. And bats, which make up more than a fifth of the 6,400 known species of mammal, are uniquely well-equipped to spread disease, with the ability to fly long distances and a unique immune system that allows them to carry a high viral load without dying or becoming ill.

Why is this threat growing?

Humans are pushing further into previously uninhabited areas, triggering a cascade of changes in the natural world. Rapid deforestation in Africa and South America pushes wildlife toward areas where people live and work, increasing the risk of interaction and disease transmission. People in many countries consume the meat and fur of wild animals — the cause of several spillover virus outbreaks, including SARS, monkeypox, and two strains of Ebola. In a recent journal study, researchers at London's Royal Veterinary College hypothesized that rodents in West African cities have enabled the rapid, transcontinental spread of monkeypox, which now infects more than 2,100 people in 42 countries, including more than 100 in the U.S. In the jet age, people infected with a novel virus in one country can spread it to the other side of the globe in a matter of hours. And climate change is poised to make the problem exponentially worse over the next 50 years.

How does climate change factor in?

Scientists warn that we have entered a new epoch: the "Pandemicene." By 2070, there will be an estimated 300,000 "first encounters" among species that don't normally interact, according to computer models run by Georgetown University researchers. Those encounters will cause about 15,000 spillovers of viruses into hosts with naïve immune systems. Some changes are already happening. Mild winters and increased rainfall are a boon for breeding mosquitoes, ticks, and other disease-carrying parasites. Over the past decade, the rate of Lyme disease incidence has doubled, and two new additional tick-borne diseases have been identified. The World Health Organization reports that dengue fever, which causes up to 390 million yearly infections worldwide, has increased 30-fold over the past 50 years.

What can be done?

Using fieldwork and computer modeling, scientists attempt to spot viral outbreaks among susceptible animals — but it would be nearly impossible to monitor all species all the time. Some countries are also cracking down on the bushmeat trade, but farmed meat also contributes to the

As humans encroach on the natural world, more deadly pandemics are likely to follow COVID. Why? Here's everything you need to know.

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spread of disease: The majority of the world's farmland helps feed and house livestock, and creating more farms often requires cutting deeper into forests and jungles. Rather than respond to new pandemics with quarantines and frantic vaccination efforts, it would be far more efficient for humanity to take global preventative measures, such as halting deforestation and new animal farms. But it may be too late to reverse the growing likelihood of viruses jumping from animals to humans. "The moment to stop climate change from increasing viral transmission was 15 years ago," said Colin Carlson, the lead author of the Georgetown study. "We have to prepare for more pandemics."

COVID's four-legged helpers

Some zoonotic viruses that afflict humans can also infect "reservoir" species like deer and pets, where they keep circulating and bouncing back to humans. Scientists have detected SARS-CoV-2 in at least 29 other animal species, including wildlife, zoo inhabitants, and pets. The early-2022 outbreak in Hong Kong, which long had a "zero COVID" policy, was traced to 11 imported pet hamsters, which could have caused a "spillback" to their human handlers. In North America, officials are more worried about deer. Last August, the Department of Agriculture detected COVID antibodies in at least one-third of white-tailed deer in Illinois, Michigan, New York, and Pennsylvania. A researcher for the USDA's Canadian counterpart found 76 mutations in the COVID strains found in deer carcasses. Some scientists even suspect that a reservoir animal was the incubator of the highly mutated Omicron variant. "I don't think we should dismiss that possibility," said Scripps Research Institute immunologist Kristian Andersen. "It's definitely on the table."

The Week, 26 June 2022

<https://theweek.com>

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Ability to balance on one leg linked to risk of death within 10 years

2022-06-22

Human balance is known to decline with age, and an international team of researchers has provided new evidence around whether this particular ability can serve as an indicator for risk of disease and death. The study involving more than 1,700 subjects found a disproportionate rate of death among those unable to complete a 10-second balance test, with the authors suggesting such an examination could become part of routine health checks from middle age onwards.

The deterioration of human balance is driven by a range of complex factors including declining bone density, loss of physical strength, and an impaired ability to process sensory information around our body's position and the surrounding environment. While an unsighted tree root can trip us up at any age, these factors, along with things like poorer cognition, worn-out joints and degenerating eyesight can increase the likelihood of a fall as we move into our later years.

Poor balance can also be indicative of other health problems, including ear infections, stroke and multiple sclerosis. The authors of this new study sought to build on this by determining whether balance could be used to assess a person's risk of death from any cause within the next decade. To do this they looked at data from 1,702 subjects, all with a stable gait and aged between 51 and 75.

The scientists analyzed metrics such as body weight, skinfold measurements, waist size and medical history, and made each participant stand on one leg for 10 seconds, with the free foot resting on the lower leg and their arms by their sides. Each person was allowed three attempts with either foot, with 348 subjects, or around one in five, failing the test.

Perhaps unsurprisingly, this failure rate rose with age. It was around five percent among the 51-55 year olds, eight percent among the 56-60 year olds, almost 18 percent among the 61-65 year olds and just under 37 percent among the 66-70 year olds. More than half of those aged 71-75 were unable to perform the 10-second balance test, making them 11 times more likely to fail than the subjects 20 years younger.

Monitoring the patients over an average follow-up period of seven years enabled the scientists to tease out some associations between balance and mortality. 123 subjects, or seven percent of the cohort, died in that

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time from a range of causes including cancer, cardiovascular disease, respiratory disease and complications from COVID-19.

Though there were no clear trends relating to the balance test results and these causes, or how long the subjects lived for, the rate of death among those that failed was significantly higher, at 17.5 percent compared to 4.5 percent. Those that failed the test were generally in poorer health with higher rates of obesity and heart disease and high blood pressure. Type 2 diabetes was around three times more common in this group.

After taking into account underlying conditions, age and sex, the scientists calculate that an inability to stand on one leg for 10 seconds was associated with an 84 percent increase in risk of death from any cause in the next decade. It is important to note there was no causal link established through the observational study, and other caveats include the exclusively white Brazilian cohort, and that around two thirds of the subjects were men.

In addition, data on history of falls, physical activity, diet and smoking was not available. This means without wider studies across different populations, it is difficult to make definitive statements about balance and the risk of death in humans. Particularly when you consider that standing on one leg, or balance in general, is something you can improve through strength training and practice, as those who have tried (and or failed) different yoga poses might attest.

The research does suggest, however, that like a blood pressure reading or blood test can be used by doctors to build a general picture of our general risk of disease, this kind of balance test could become a cheap, non-invasive tool in the context of routine healthcare.

“The one-legged stance test has been used to assess balance over the last five decades, but it is not routinely employed in the clinical examination of middle-aged and older individuals,” said study co-author Dr Setor Kunutsor. “A major reason for this is the lack of data on its relationship with adverse outcomes such as falls and mortality. The current findings suggest the 10-second one-legged stance is a potential practical tool that could be used in routine clinical practice to identify middle-aged and older individuals at high risk of death. We encourage researchers with access to these data to publish their findings to confirm these results.”

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The research was published in the journal *British Journal of Sports Medicine*.

New Atlas, 22 June 2022

<https://newatlas.com>

New fluorophores could help fight cancer

2022-06-27

Scientists from the Ural Federal University and the Ural Branch of the Russian Academy of Sciences have created new fluorescent chemical compounds (fluorophores) for photodynamic therapy of cancerous tumors, the latest method of treating cancer. The compound is suitable simultaneously for the diagnosis of tumor processes by staining the affected tissues and their further treatment by destroying tumor cells without harm to healthy ones. The results of the primary studies were published in the *Dyes and Pigments* journal.

The synthesis of these fluorophores is characterized by low cost, due to the availability of all derivatives in the composition, as well as the absence of impurities that could lead to side effects. The effectiveness of the fluorophore was tested on HeLa cells used as a model of cervical cancer. Now scientists are testing how the new compound interacts with other types of cancer cells.

Fluorophores are chemical compounds that emit visible light (photoluminescence) when exposed to ultraviolet or visible light. They are able to spread through biological tissues and stain cells prone to inflammatory processes. Thus, a new compound interacts with biomolecules of body tissues and, under UV or visible irradiation, stains areas in which the process of tumor growth is taking place. This makes it possible to determine the size of the tumor in the body and outline its boundaries. During the experiments, scientists found that the new fluorophore performs a dual function: it not only stains diseased areas, but also begins to destroy them.

“Initially, we investigated only the dyeing properties of the compound,” says Grigory Zyryanov, co-author of the study and Professor of the Department of Organic and Biomolecular Chemistry at UrFU. “The compound is able to accumulate in certain areas of the cell—the cell membrane and reticulum (an intracellular organelle responsible for protein folding), and under ultraviolet or visible irradiation, highlight the

“The compound is able to accumulate in certain areas of the cell [...] and under ultraviolet or visible irradiation, highlight the infected areas in bright green.”

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infected areas in bright green. However, it turned out that the fluorophore then functions as a photosensitizer.

“That is, under the influence of optical irradiation, it begins to interact with the surrounding cellular environment (oxygen, water, etc.) and generates free radicals, the so-called reactive oxygen species. These active particles enter into chemical interactions with affected cells, starting their destruction, while practically not affecting healthy ones. This is called photodynamic therapy, it is a new promising method of cancer treatment with high efficiency and minimum side effects.”

Scientists using the methods of heterocyclic chemistry created two experimental samples. Chemists synthesized a fluorophore based on naphthoxazole, an oxazole derivative used in the synthesis of medicinal and biochemical preparations, and a naphthalene fragment used as a platform and so-called antenna for more efficient perception of optical irradiation by a molecule. In addition, chemists added fragments of pyrene and anthracene, polynuclear aromatic hydrocarbons with a high fluorescent response, that is, a bright glow, to the compound. The compound containing pyrene showed the highest fluorescent and anticancer activity.

“Pyrenes are very commonly used for bioimaging, anthracenes are less common,” says Grigory Zyryanov. “These compounds are promising for many reasons, including we were able to show that the pyrene-containing compound begins to glow even when irradiated with visible light, and this is visible even to the naked eye. This is very convenient, including, for example, for surgical interventions, when it is still necessary in the treatment.”

Phys Org, 27 June 2022

<https://phys.org>

Artificial photosynthesis lets plants grow efficiently in total darkness

2022-06-26

Scientists have improved on the natural process of photosynthesis, not only growing plants more efficiently, but doing so in the dark. This could expand agriculture to areas that don't get enough sunlight, and even help feed future space explorers.

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As you may recall from elementary school science class, photosynthesis is where plants absorb energy from sunlight and use it to create their own food from carbon dioxide and water. The process has helped plants – and by extension, life on Earth – thrive for billions of years, but that doesn't mean it's particularly efficient. In fact, only about three to six percent of the sunlight energy ends up in the plant.

Scientists have long tinkered with artificial photosynthesis, which is already much more efficient than the natural process. So-called artificial leaves can be used as an environmentally friendly way to make a range of products, including hydrogen fuel, syngas, methanol, plastic alternatives, and even drug molecules.

In this case, the resulting product was acetate, the main component of vinegar. This was then fed to plants as a carbon source, essentially bypassing natural photosynthesis. The team tested the technique on a series of crop plants and food-producing microbes, including yeast, green algae, fungal mycelium, cowpea, tomato, tobacco, rice, canola and green pea.

Using artificial photosynthesis approaches to produce food could be a paradigm shift for how we feed people

The scientists showed that the organisms could all be grown in an acetate medium in total darkness, and in some cases even more efficiently than in sunlight. The algae, for instance, was grown four times more efficiently, while yeast production was boosted an astonishing 18 times.

“We found that a wide range of crops could take the acetate we provided and build it into the major molecular building blocks an organism needs to grow and thrive,” said Marcus Harland-Dunaway, co-lead author of the study. “With some breeding and engineering that we are currently working on we might be able to grow crops with acetate as an extra energy source to boost crop yields.”

By uncoupling agriculture from the need for direct sunlight, the technique could enable food to be grown in regions with less ideal conditions, using less land. Crops could be grown in cities, and even in space or on other planets, an angle that earned the project a win in Phase I of NASA's Deep Space Food Challenge.

“Using artificial photosynthesis approaches to produce food could be a paradigm shift for how we feed people,” said Robert Jinkerson, corresponding author of the study. “By increasing the efficiency of food

Using artificial photosynthesis approaches to produce food could be a paradigm shift for how we feed people.

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production, less land is needed, lessening the impact agriculture has on the environment. And for agriculture in non-traditional environments, like outer space, the increased energy efficiency could help feed more crew members with less inputs.”

The research was published in the journal *Nature Food*.

New Atlas, 26 June 2022

<https://newatlas.com>

First reported case of a person getting COVID from a cat

2022-06-29

First there were sneezing hamsters, now sneezing cats. A team in Thailand reports the first solid evidence of a pet cat infecting a person with SARS-CoV-2 — adding felines to the list of animals that can transmit the virus to people.

Researchers say the results are convincing. They are surprised that it has taken this long to establish that transmission can occur, given the scale of the pandemic, the virus’s ability to jump between animal species, and the close contact between cats and people. “We’ve known this was a possibility for two years,” says Angela Bosco-Lauth, an infectious-disease researcher at Colorado State University in Fort Collins.

Studies early in the pandemic found that cats shed infectious virus particles and can infect other cats. And over the course of the pandemic, countries have reported SARS-CoV-2 infections in dozens of pet cats. But establishing the direction of viral spread — from cat to person or from person to cat — is tricky. The Thai study “is an interesting case report, and a great example of what good contact tracing can do,” says Marion Koopmans, a virologist at the Erasmus University Medical Center in Rotterdam, the Netherlands.

The feline finding, published in *Emerging Infectious Diseases* on 6 June, came about by accident, says co-author Sarunyou Chusri, an infectious-disease researcher and physician at Prince of Songkla University in Hat Yai, southern Thailand. In August, a father and son who had tested positive for SARS-CoV-2 were transferred to an isolation ward at the university’s hospital. Their ten-year-old cat was also swabbed and tested positive. While being swabbed, the cat sneezed in the face of a veterinary surgeon, who was wearing a mask and gloves but no eye protection.

Scientists in Thailand have established that a tabby passed SARS-CoV-2 to a veterinary surgeon — although such cases of cat-to-human transmission are probably rare.

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Three days later, the vet developed a fever, sniffles and a cough, and later tested positive for SARS-CoV-2, but none of her close contacts developed COVID-19, suggesting that she had been infected by the cat. Genetic analysis also confirmed that the vet was infected with the same variant as the cat and its owners, and the viral genomic sequences were identical.

Low risk

Researchers say that such cases of cat-to-human transmission are probably rare. Experimental studies have shown that infected cats don’t shed much virus, and shed for only a few days, says Leo Poon, a virologist at the University of Hong Kong.

Still, Chusri says it is worth taking extra precautions when handling cats suspected of being infected. People “should not abandon their cats, but take more care of them”, he says.

Other animals suspected of infecting people include farmed mink in Europe and North America, pet hamsters in Hong Kong and wild white-tailed deer in Canada. Adding cats to the list “expands our understanding of the zoonotic potential of this virus”, says Poon.

But researchers say these are all rare events and animals don’t yet play a significant part in spreading the virus. “Humans are clearly still the major source of the virus,” says Bosco-Lauth.

Nature, 29 June 2022

<https://nature.com>

Common bone density scan can predict later-life dementia risk

2022-06-27

Researchers can now assess a person’s risk of developing late-life dementia using data from a common type of bone density scan. The long-term study revealed calcification within the abdominal aorta can double one’s risk of developing dementia over the age of 80.

The new study analyzed data from a long-term research project called The Perth Longitudinal Study of Aging Women. The project initially was focused on understanding how calcium supplements can prevent osteoporotic fractures, but it included well over 10 years of valuable follow-up health data.

A certain biomarker picked up by the common scan was linked to a doubling of dementia risk over the following 15 years.

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A team of researchers from Australia's Edith Cowan University re-examined data from that study, hypothesizing that certain biomarkers gathered from bone density scans could be used to predict the onset of dementia up to 15 years later. The focus was on a biomarker called abdominal aortic calcification (AAC), a build-up of calcium in the body's largest artery. AAC is currently used to predict a person's risk of cardiovascular disease and stroke.

Looking at health records from nearly 1,000 women, the researchers found those subjects with medium to high AAC in their mid-70s were twice as likely to be hospitalized or die from dementia over the following 15 years.

It's generally very quick and easy to capture these scans and they are less-invasive, cheaper and miniscule in radiation exposure compared to X-rays or CT scans

One of the study's authors, Joshua Lewis, said bone density scans are incredibly common tests for senior citizens, with more than half a million conducted each year in Australia alone. The machines are widely available, meaning these tests could be easily incorporated into current health screening programs.

"It's generally very quick and easy to capture these scans and they are less-invasive, cheaper and miniscule in radiation exposure compared to X-rays or CT scans," said Lewis. "It means these scans may be a cheap, rapid and safe way to screen a large number of susceptible older Australians for higher late-life dementia risk."

The study also indicates there to be a significant overlap in the relationship between cardiovascular health and brain health. Simon Laws, another researcher working on the project, said identifying AAC as a risk factor in late-life dementia opens the door to lifestyle and dietary interventions that could help people prevent cognitive decline in their 80s.

"There's an adage in dementia research that what's good for your heart is good for your brain," Laws said. "What's come to light is the importance of modifying risk factors such as diet and physical activity in preventing dementia: you need to intervene early and hopefully this study allows for the earliest possible change and the greatest impact."

More research will be needed to better understand the mechanisms that could link AAC and later-life dementia. It's also unclear whether the correlation holds as strongly for men as it does women.

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Nevertheless, in the short-term these findings offers doctors and patients a novel way to use data from a common bone scan in assessing one's risk of developing dementia in the subsequent years.

The new study was published in the journal The Lancet Regional Health.

New Atlas, 27 June 2022

<https://newatlas.com>

Enzyme in human salivary microbes decomposes PET-based plastics

2022-06-29

Human saliva may contain an enzyme which can decompose the plastic polyethylene terephthalate (PET). Researchers found the promising enzyme, a hydrolase, in a database containing human metagenome samples. As they report in the journal *Angewandte Chemie International Edition*, this newly discovered hydrolase performs better than many other known bacterial PET hydrolases. It can be produced using biotechnological methods and could be put to use in plastic recycling or for functionalizing plastics, the authors add.

Landfill sites and harbors are known to be particularly promising sites for finding bacteria that have adapted to consume or make use of plastics. These bacteria have evolved enzymes, known as PET hydrolases, which can break PET down into smaller molecules. Chayasith Uttamapinant from the Vidyasirimedhi Institute of Science and Technology (VISTEC) in Rayong, Thailand, and Worawan Bhanthumnavin from Chulalongkorn University, Bangkok, Thailand, and colleagues, have now discovered the first enzyme to decompose PET from a rather more surprising source: the genome of microbial communities in human saliva.

The researchers believe that, because humans consume vast amounts of food which has been packaged using PET, microbes in the saliva, or the GI tract, may have evolved to digest microplastics. The team uncovered the new hydrolase, which they named MG8, while searching a public metagenome database containing samples from seawater and human saliva, and were able to attribute the likely source of the enzyme to Gram-negative bacteria that may reside in human saliva. These bacteria are similar to strains found near the "Pacific trash vortex," which have also evolved to produce PET hydrolases.

The researchers believe that, because humans consume vast amounts of food which has been packaged using PET, microbes in the saliva, or the GI tract, may have evolved to digest microplastics.

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They first needed enough material to perform their experiments, and so they modified a bacterium that can be cultured in laboratories to produce the enzyme. They easily recovered an active form of the enzyme, able to decompose PET, from a denatured form that can be isolated in large amounts. The researchers highlight that this shows great promise for scaling up in the future.

Aside from the prospects for recycling scalability, the team also foresees another use of MG8. They discovered that not only can it decompose PET with ease but, with a small modification, it can also bind to it highly effectively. To achieve this, they modified the protein sequence by replacing one of the naturally occurring amino acids (serine) at the active site with an unnatural amino acid, DAP. The modified enzyme immediately adhered to PET powder. This could be used as a vehicle for functionalizing PET surfaces, increasing the versatility of PET in medical devices, for example, and enhancing the versatility of recycled PET.

Despite the promise of MG8 in plastic recycling and functionalization, the team acknowledges that MG8, like other PET hydrolases, still needs some work. For the time being, consumer-grade PET plastics with high crystallinity cannot be decomposed using this hydrolase. Therefore, further research will be necessary to reach the stage where a whole plastic water bottle can be dissolved in a simple solution containing the enzyme.

Phys Org, 29 June 2022

<https://phys.org>

New Study Finds Gas Stoves Release Toxic Chemicals — Even When Turned Off

2022-06-29

Gas stoves have long been a sought-after kitchen upgrade, but a new study shows that cooking with gas isn't all it's cracked up to be — and is actually dumping toxic chemicals into the air inside your home.

Scientists have long known that methane from gas ranges is a significant contributor to the greenhouse gas methane, but methane isn't the only problematic chemical gas stoves give off. A new study published in the journal *Environmental Science & Technology* explains that it's not just natural gas that comes out of your burner, but known carcinogens and other toxic chemicals too. The researchers found that natural gas contains a number of air toxics — a special EPA categorization for chemicals known to cause cancer and other serious health problems.

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"It is well-established that natural gas is a major source of methane that's driving climate change," lead study author Drew Michanowicz, a visiting scientist at Harvard Chan C-CHANGE, senior scientist at PSE Healthy Energy, said in a statement. "But most people haven't really considered that our homes are where the pipeline ends and that when natural gas leaks, it can contain health-damaging air pollutants in addition to climate pollutants."

To determine levels of toxic compounds present in natural gas, researchers from the Harvard T.H. Chan School of Public Health evaluated 200 unburnt natural gas samples collected from 69 stoves and pipelines in the Boston metro area between December 2019 and May 2021. They found that the samples contained at least 21 air toxics.

In many cases, odorants used to alert homeowners to a gas leak were undetectable in small leaks, meaning gas leaks go unrealized, compromising indoor air quality.

"This study shows that gas appliances like stoves and ovens can be a source of hazardous chemicals in our homes even when we're not using them. These same chemicals are also likely to be present in leaking gas distribution systems in cities and up the supply chain," said Jonathan Buonocore, co-author of the study and a research scientist at Harvard Chan C-CHANGE, in a press release for the study.

The research team found concerning levels of many toxic compounds, including benzene, which is a known carcinogen that affects red and white blood cells. It can cause anemia and negatively impact immune function. Benzene is heavily regulated, and, according to the study, there is no safe level of exposure to benzene. Yet 95% of the natural gas samples evaluated contained benzene.

Other compounds found in the samples include methane, ethylbenzene, xylene, toluene, and many other pollutants categorized by the EPA as hazardous. These chemicals are leaking into the homes of families everywhere and negatively affecting indoor air quality, potentially causing severe health problems or exacerbating existing conditions.

In recent years, there has been a push to remove gas stoves and ovens from homes and replace them with electric appliances. But that's not a budget item many families can afford right now. If it's not feasible for your

Ninety-five percent of the gas stoves tested released the carcinogen benzene.

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family, experts recommend turning on a ventilation fan or hood before you light your burner — not just after the burner is lit.

Fatherly, 29 June 2022

<https://fatherly.com>

Could carbon monoxide foam help fight inflammation?

2022-06-29

Carbon monoxide is best known as a potentially deadly gas. However, in small doses it also has beneficial qualities: It has been shown to reduce inflammation and can help stimulate tissue regeneration.

A team of researchers led by MIT, Brigham and Women's Hospital, the University of Iowa, and Beth Israel Deaconess Medical Center has now devised a novel way to deliver carbon monoxide to the body while bypassing its potentially hazardous effects. Inspired by techniques used in molecular gastronomy, they were able to incorporate carbon monoxide into stable foams that can be delivered to the digestive tract.

In a study of mice, the researchers showed that these foams reduced inflammation of the colon and helped to reverse acute liver failure caused by acetaminophen overdose. The new technique, described today in a Science Translational Medicine paper, could also be used to deliver other therapeutic gases, the researchers say.

"The ability to deliver a gas opens up whole new opportunities of how we think of therapeutics. We generally don't think of a gas as a therapeutic that you would take orally (or that could be administered rectally), so this offers an exciting new way to think about how we can help patients," says Giovanni Traverso, the Karl van Tassel Career Development Assistant Professor of Mechanical Engineering at MIT and a gastroenterologist at Brigham and Women's Hospital.

Traverso and Leo Otterbein, a professor of surgery at Harvard Medical School and Beth Israel Deaconess Medical Center, are the senior authors of the paper. The lead authors are James Byrne, a physician-scientist and radiation oncologist at the University of Iowa (formerly a resident in the Mass General Brigham/Dana Farber Radiation Oncology Program), and a research affiliate at MIT's Koch Institute for Integrative Cancer Research; David Gallo, a researcher at Beth Israel Deaconess; and Hannah Boyce, a research engineer at Brigham and Women's.

Delivery by foam

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Since the late 1990s, Otterbein has been studying the therapeutic effects of low doses of carbon monoxide. The gas has been shown to impart beneficial effects in preventing rejection of transplanted organs, reducing tumor growth, and modulating inflammation and acute tissue injury.

When inhaled at high concentrations, carbon monoxide binds to hemoglobin in the blood and prevents the body from obtaining enough oxygen, which can lead to serious health effects and even death. However, at lower doses, it has beneficial effects such as reducing inflammation and promoting tissue regeneration, Otterbein says.

"We've known for years that carbon monoxide can impart beneficial effects in all sorts of disease pathologies, when given as an inhaled gas," he says. "However, it's been a challenge to use it in the clinic, for a number of reasons related to safe and reproducible administration, and health care workers' concerns, which has led to people wanting to find other ways to administer it."

A few years ago, Traverso and Otterbein were introduced by Christoph Steiger, a former MIT postdoc and an author of the new study. Traverso's lab specializes in developing novel methods for delivering drugs to the gastrointestinal tract. To tackle the challenge of delivering a gas, they came up with the idea of incorporating the gas into a foam, much the way that chefs use carbon dioxide to create foams infused with fruits, vegetables, or other flavors.

Culinary foams are usually created by adding a thickening or gelling agent to a liquid or a solid that has been pureed, and then either whipping it to incorporate air or using a specialized siphon that injects gases such as carbon dioxide or compressed air.

The MIT team created a modified siphon that could be attached to any kind of gas cannister, allowing them to incorporate carbon monoxide into their foam. To create the foams, they used food additives such as alginate, methyl cellulose, and maltodextrin. Xanthan gum was also added to stabilize the foams. By varying the amount of xanthan gum, the researchers could control how long it would take for the gas to be released once the foams were administered.

After showing that they could control the timing of the gas release in the body, the researchers decided to test the foams for a few different applications. First, they studied two types of topical applications, analogous to applying a cream to soothe itchy or inflamed areas. In a study of mice, they found that delivering the foam rectally reduced inflammation

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caused by colitis or radiation-induced proctitis (inflammation of the rectum that can be caused by radiation treatment for cervical or prostate cancer).

Current treatments for colitis and other inflammatory conditions such as Crohn's disease usually involve drugs that suppress the immune system, which can make patients more susceptible to infections. Treating those conditions with a foam that can be applied directly to inflamed tissue offers a potential alternative, or complementary approach, to those immunosuppressive treatments, the researchers say. While the foams were given rectally in this study, it could also be possible to deliver them orally, the researchers say.

"The foams are so easy to use, which will help with the translation to patient care," Byrne says.

Controlling the dose

The researchers then set out to investigate possible systemic applications, in which carbon monoxide could be delivered to remote organs, such as the liver, because of its ability to diffuse from the GI tract elsewhere in the body. For this study, they used a mouse model of acetaminophen overdose, which causes severe liver damage. They found that gas delivered to the lower GI tract was able to reach the liver and greatly reduce the amount of inflammation and tissue damage seen there.

In these experiments, the researchers did not find any adverse effects after the carbon monoxide administration. Previous studies in humans have shown that small amounts of carbon monoxide can be safely inhaled. A healthy individual has a carbon monoxide concentration of about 1 percent in the bloodstream, and studies of human volunteers have shown that levels as high as 14 percent can be tolerated without adverse effects.

"We think that with the foam used in this study, we're not even coming close to the levels that we would be concerned about," Otterbein says. "What we have learned from the inhaled gas trials has paved a path to say it's safe, as long as you know and can control how much you're giving, much like any medication. That's another nice aspect of this approach—we can control the exact dose."

In this study, the researchers also created carbon-monoxide containing gels, as well as gas-filled solids, using techniques similar to those used to make Pop Rocks, the hard candies that contain pressurized carbon

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dioxide bubbles. They plan to test those in further studies, in addition to developing the foams for possible tests in human patients.

Medical Xpress, 29 June 2022

<https://medicalxpress.com>

Body's Aging Processes Speed Up Soon After HIV Infection

2022-07-01

HIV has an "early and substantial" impact on aging in infected people, accelerating biological changes in the body associated with normal aging within just two to three years of infection, according to a study by UCLA researchers and colleagues.

The findings suggest that new HIV infection may rapidly cut nearly five years off an individual's life span relative to an uninfected person.

"Our work demonstrates that even in the early months and years of living with HIV, the virus has already set into motion an accelerated aging process at the DNA level," said lead author Elizabeth Crabb Breen, a professor emerita at UCLA's Cousins Center for Psychoneuroimmunology and of psychiatry and biobehavioral sciences at the David Geffen School of Medicine at UCLA. "This emphasizes the critical importance of early HIV diagnosis and an awareness of aging-related problems, as well as the value of preventing HIV infection in the first place."

The study is published today in the peer-reviewed journal *iScience*.

Previous research has suggested that HIV and antiretroviral therapies used to keep the infection under control are associated with an earlier onset of age-related conditions typically associated with aging, such as heart and kidney disease, frailty, and cognitive difficulties.

The research team analyzed stored blood samples from 102 men collected six months or less before they became infected with HIV and again two to three years after infection. They compared these with matching samples from 102 non-infected men of the same age taken over the same time period. The authors say this study is the first to match infected and non-infected people in this way. All the men were participants in the Multicenter AIDS Cohort Study, an ongoing nationwide study initiated in 1984.

The findings suggest that new HIV infection may rapidly cut nearly five years off an individual's life span relative to an uninfected person.

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The researchers focused on how HIV affects epigenetic DNA methylation, a process cells use to turn genes on or off in the course of normal physiological changes. Epigenetic changes are those made in response to the influence of environment, people's behaviors or other outside factors — such as disease — that affect how genes behave without changing the genes themselves.

The team examined five epigenetic measures of aging. Four of them are what are known as epigenetic “clocks,” each of which uses a slightly different approach to estimate biological age acceleration in years, relative to chronologic age. The fifth measure assessed the length of telomeres, the protective cap-like ends of chromosomes that become progressively shorter with age as cells divide, until they become so short that division is no longer possible.

HIV-infected individuals showed significant age acceleration in each of the four epigenetic clock measurements — ranging from 1.9 to 4.8 years — as well as telomere shortening over the period beginning just before infection and ending two to three years after, in the absence of highly active antiretroviral treatment. Similar age acceleration was not seen in the non-infected participants over the same time interval.

“Our access to rare, well-characterized samples allowed us to design this study in a way that leaves little doubt about the role of HIV in eliciting biological signatures of early aging,” said senior author Beth Jamieson, a professor in the division of hematology and oncology at the Geffen School. “Our long-term goal is to determine whether we can use any of these signatures to predict whether an individual is at increased risk for specific aging-related disease outcomes, thus exposing new targets for intervention therapeutics.”

The researchers noted some limitations to the study. It included only men, so results may not be applicable to women. In addition, the number of non-white participants was small, and the sample size was insufficient to take into consideration later effects of highly active antiretroviral treatment or to predict clinical outcomes.

There is still no consensus on what constitutes normal aging or how to define it, the researchers wrote.

Technology Networks, 1 July 2022

<https://website>

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Intermittent fasting may help heal nerve damage

2022-06-27

Intermittent fasting changes the gut bacteria activity of mice and increases their ability to recover from nerve damage.

The new research is published in Nature and was conducted by Imperial College London researchers. They observed how fasting led to the gut bacteria increasing production of a metabolite known as 3-Indolepropionic acid (IPA), which is required for regenerating nerve fibers called axons—thread-like structures at the ends of nerve cells that send out electro-chemical signals to other cells in the body.

This novel mechanism was discovered in mice and is hoped to also hold true for any future human trials. The team state that the bacteria that produces IPA, Clostridium sporogenesis, is found naturally in the guts of humans as well as mice and IPA is present in human's bloodstreams too.

“There is currently no treatment for people with nerve damage beyond surgical reconstruction, which is only effective in a small percentage of cases, prompting us to investigate whether changes in lifestyle could aid recovery,” said study author Professor Simone Di Giovanni from Imperial's Department of Brain Sciences.

“Intermittent fasting has previously been linked by other studies to wound repair and the growth of new neurons—but our study is the first to explain exactly how fasting might help heal nerves.”

Fasting as a potential treatment

The study assessed nerve regeneration of mice where the sciatic nerve, the longest nerve running from the spine down the leg, was crushed. Half of the mice underwent intermittent fasting (by eating as much as they liked followed by not eating at all on alternate days), while the other half were free to eat with no restrictions at all. These diets continued for a period of 10 days or 30 days before their operation, and the mice's recovery was monitored 24 to 72 hours after the nerve was severed.

The length of the regrown axons was measured and was about 50% greater in mice that had been fasting.

Professor Di Giovanni said, “I think the power of this is that opens up a whole new field where we have to wonder: is this the tip of an iceberg? Are there going to be other bacteria or bacteria metabolites that can promote repair?”

“There is currently no treatment for people with nerve damage beyond surgical reconstruction, which is only effective in a small percentage of cases.”

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Investigation reveals metabolism link

The researchers also studied how fasting led to this nerve regeneration. They found that there were significantly higher levels of specific metabolites, including IPA, in the blood of diet-restricted mice.

To confirm whether IPA led to nerve repair, the mice were treated with antibiotics to clean their guts of any bacteria. They were then given genetically-modified strains of *Clostridium sporogenesis* that could or could not produce IPA.

“When IPA cannot be produced by these bacteria and it was almost absent in the serum, regeneration was impaired. This suggests that the IPA generated by these bacteria has an ability to heal and regenerate damaged nerves,” Professor Di Giovanni said.

Importantly, when IPA was administered to the mice orally after a sciatic nerve injury, regeneration and increased recovery was observed between two and three weeks after injury.

The next stage for this research will be to test this mechanism for spinal cord injuries in mice as well as testing whether administering IPA more frequently would maximize its efficacy.

“One of our goals now is to systematically investigate the role of bacteria metabolite therapy.” Professor Di Giovanni said.

More studies will need to investigate whether IPA increases after fasting in humans and the efficacy of IPA and intermittent fasting as a potential treatment in people.

He said: “One of the questions that we haven’t explored fully is that, since IPA lasts in blood for four to six hours in high concentration, would administering it repeatedly throughout the day or adding it to a normal diet help maximize its therapeutic effects?”

Medical Xpress, 27 June 2022

<https://medicalxpress.com>

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