CHEMWATCH

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ASIA PACIFIC

Poor air quality forces closure of schools, government offices in Tehran

2022-07-05

Educational institutes and government offices in Tehran and other Iranian cities were forced to close on Monday over the deteriorating air pollution in the country.

According to the Tehran Air Quality Control Company, the air quality index (AQI) in the city was recorded at 116 on Monday, deemed unhealthy for all sensitive groups.

Since the beginning of the year, Tehran has had 63 days of acceptable air, four days of unhealthy air (for all people), 34 days of unhealthy air (sensitive groups), two days of dangerous air, and two days of clean air, the company said.

It's the second time since April that schools and government offices have been shut in Tehran due to worsening air quality fueled by severe sand storms.

All sports venues across 22 districts of the capital were also closed for activities.

On Sunday, for the fourth time in the current Iranian calendar year that starts March 21, Tehran became the most polluted city in the world, with an alarming dip in the air quality index.

IQAir, the Switzerland-based air quality technology firm, announced that the air quality index in Tehran was 277 units.

The problem of sand storms in Iran has taken an alarming turn in recent months, with authorities saying they originate in neighboring countries such as Iraq and Syria.

"It's become worse in the past few months so much so that at times things are barely visible beyond 50-60 meters," said Amir Saedi, a trader in downtown Tehran.

For Alireza Hashemi, a Tehran-based university student, the scourge of air pollution was assuming alarming proportions, making it difficult to walk out without protective masks.

Air quality has rapidly deteriorated in Iran in recent months due to severe sand storms

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AA, 5-7-22

https://www.aa.com.tr/en/middle-east/poor-air-quality-forces-closure-of-schools-government-offices-in-tehran/2629837

'Every year it gets worse': on the frontline of the climate crisis in Bangladesh

2022-07-06

Ever since she was a little girl, Amina Ahmed has been afraid of the water. Growing up in Sylhet, north-east of Bangladesh, the heavy rainfall that typically occurs during monsoon season would make her anxious.

But this year's flooding has been unlike anything she's ever seen before. "Every year, it gets a little worse but I don't think anyone expected anything this extreme," Ahmed says.

Over the past few weeks, catastrophic flash floods – the worst in Bangladesh in a century – have inundated much of Sylhet, where rising waters have washed away whole towns, killing at least 68 people and leaving thousands displaced. According to the UN, an estimated 7.2 million people across seven districts have been affected.

Now 24, Ahmed, from Mirabazar, is a volunteer for the Bangladesh Red Crescent, where she is part of a team leading rescue and relief operations during the current crisis.

When the recent flooding began, Ahmed's team tried to reach people in remote areas and bring them safely to shelter. They carried small children for those struggling to stay afloat and provided regular reassurance to terrified families, as well as cooked meals, clean drinking water and medicine.

Ahmed recognises that women in Sylhet are more likely to be affected by the climate emergency than men, which is a key motivation for her work. "I'm in the best position to help impacted women as I personally understand the gender-based issues that they face," she says.

Read More

The Guardian, 6-07-22

https://www.theguardian.com/environment/2022/jul/05/every-year-it-gets-worse-on-the-frontline-of-the-climate-crisis-in-bangladesh

Pollution severity-regulated effects of roof strategies on China's winter PM2.5

2022-07-04

Urbanization took place rapidly over recent decades and is expected to continue in the future, producing a series of environmental issues, including heat stress. Cool roof and green roof strategies have been adopted in a number of megacities to mitigate urban heat and carbon emissions, yet China is lagging behind developed countries in the implementation. One reason is the lack of careful and thoughtful assessment of potential effects of roof strategies, including their influences on winter PM2.5. With numerical simulations in this study, we assess how cool and green roof strategies affect winter PM2.5 pollution in North China, and we find that adoptions of cool roofs tend to aggravate PM2.5 pollution in lightly polluted regions. When PM2.5 pollution worsens, the negative effects of cool roofs are likely to be diminished. Green roofs cause less enhancements of PM2.5 pollution as a result of inhibited evapotranspiration in winter. We demonstrate that the effects of roof strategies are regulated by pollution severity and conclude that green roofs with suppressed evapotranspiration and thus weaker penalty on winter PM2.5 pollution seem to be better choices given the current pollution severity level in China, especially for regions suitable for growth of broadleaf plants.

Read More

Nature, 4-07-22

https://www.nature.com/articles/s41612-022-00278-y

India imposes ban on single-use plastics. But will it be enforced?

2022-07-01

India on Friday became the latest country to impose a ban on most single-use plastics, part of a growing but patchy global effort to tackle a leading source of pollution. The challenges of enforcement are enormous, experts say, but so are the potential gains.

Only a small fraction of the plastic produced globally is recycled. Most is single-use, or disposable. It often winds up in landfills, rivers and oceans, or is burned, a significant contributor to air pollution in developing nations. Though these plastics are used only briefly, they can take

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hundreds of years to decompose. By 2050, there will be about 12 billion tons of plastic waste in the world, the United Nations estimates.

Plastic debris is ubiquitous in India: stacked along roadsides, floating in waterways and choking drainage systems. The country is the world's third-largest producer of plastic waste, trailing only the United States and China, according to a recent report from Australia's Minderoo Foundation.

India announced its ambitious initiative last year. Now, the manufacture, sale or import of widely used items such as plastic cutlery, ice cream sticks, and film on cigarette packs and candy boxes are banned. Plastic bags, another major pollutant, are not on the list for now, but the government has mandated an increase in thickness to make them easier to reuse. Some plastic packaging used for consumer food products will be excluded from the ban, but manufacturers are tasked with ensuring that it is recycled.

Read More

The Washington Post, 1-07-22

https://www.washingtonpost.com/world/2022/07/01/india-single-use-plastic-ban-pollution/

AMERICA

We Need To Get The Lead Out. Now

2022-06-29

We've heard this story so many times, it's lost its shock. Lead found in our cities, our neighborhoods, our schools, our plumbing. Since the scandal in Flint, Michigan came to light in 2016, lead in our water has been a running story in our newsfeeds. And no wonder — every state in the country has lead service lines.

A reminder: there is no safe level of lead in drinking water, and it's especially dangerous for children. It can lead to developmental disorders, damage to the nervous system and blood cells, and more. In 2021, out of a million children in the U.S. tested, half showed detectable levels of lead in their blood. Lead exposure is much more likely for poorer children and children of color, reinforcing historical inequities.

Replacing lead lines is a human rights issue, a public health issue and a social justice issue. Yet, our elected officials have dragged their feet on full funding to fix this problem. Meanwhile, corporations are targeting

municipal governments for privatization — which only stands to worsen the crisis.

The Link Between Lead And The Loss Of Local Control

Flint's lead crisis began when a state-appointed emergency manager took control of the city and changed its water source, supposedly to cut costs. Then-Governor Rick Snyder used the state emergency manager law to strip majority Black cities of democratic decision-making. This put money for bondholders before the health and wellbeing of residents. Immediately after the switch, residents raised the alarm about the gross, discolored water. The state emergency manager's response? To repeatedly insist that the water was safe to drink.

Read More

Food & Water Watch, 29-06-22

https://www.foodandwaterwatch.org/2022/06/29/we-need-to-get-the-lead-out-now/

Plastics Legislation Needed, Not Increased Costs on Americans

2022-06-30

Today the House Energy and Commerce Subcommittee on Environment and Climate Change is holding a hearing to discuss four bills pertaining to plastics and recycling. The following may be attributed to Joshua Baca, vice president of plastics at the American Chemistry Council (ACC).

"Today's hearing by the House Subcommittee on Environment and Climate Change to discuss plastics and sustainability is a key step toward creating effective, bipartisan legislation to address plastics in the environment and to improve recycling collection and rates. Plastics are vital materials that have helped usher in our modern life and are essential to meeting sustainable development goals. Any legislation must not take us backwards.

"Last year America's plastic makers released 5 Actions for Sustainable Change, and we are urging Congress to pass legislation reflecting those solutions. These 5 Actions are more comprehensive than the Break Free From Plastic Pollution Act of 2021 (BFFPPA) in that they address all plastic packaging, not a narrow list of plastic items. The 5 Actions also would dramatically improve recycling by fostering advanced recycling, instead of

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discounting the innovative recycling technologies needed to rapidly ramp up plastics recycling to meet growing demand.

"The BFFPPA appears tone deaf to the struggles facing Americans today. Inflation is at 40-year highs, supply chains are still constrained, and gas prices are soaring. Yet proponents of the BFFPPA would raise the costs of essential items that Americans depend on, from baby formula to food to body wash. Additionally, the legislation would risk 910,000 jobs and curtail $413 billion in output over five years. As recession risks loom, now is not the time to purposefully slow down the U.S. economy.

"But we must act to improve plastics recycling and help prevent plastics from entering our environment. Both the Recycling and Composting Accountability Act and the Recycling Infrastructure and Accessibility Act of 2022 reflect commonsense approaches to improve recycling in the U.S. ACC supports these bills and urges Congress to go even further by requiring all U.S. plastic packaging to contain at least 30% recycled plastic by 2030, and by supporting producer responsibility systems to raise private funds to build more recycling infrastructure.

Read More

American Chemistry Council, 30-06-22

https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2022/plastics-legislation-needed-not-increased-costs-on-americans

FDA bans Juul e-cigarettes tied to teen vaping surge

2022-06-24

U.S. health regulators on Thursday ordered Juul to pull its electronic cigarettes from the market, the latest blow to the embattled company widely blamed for sparking a national surge in teen vaping.

The action is part of a sweeping effort by the Food and Drug Administration to bring scientific scrutiny to the multibillion-dollar vaping industry after years of regulatory delays.

The FDA said Juul must stop selling its vaping device and its tobacco and menthol flavored cartridges. Those already on the market must be removed. Consumers aren't restricted from having or using Juul's products, the agency said.

To stay on the market, companies must show that their e-cigarettes benefit public health. In practice, that means proving that adult smokers who use them are likely to quit or reduce their smoking, while teens are unlikely to get hooked on them.

The FDA noted that some of the biggest sellers like Juul may have played a "disproportionate" role in the rise in teen vaping. The agency said Thursday that Juul's application didn't have enough evidence to show that marketing its products "would be appropriate for the protection of the public health."

Read More

AP News, 24-06-22

https://apnews.com/article/juul-banned-fda-e41c58872a0e7a202ca5244442accb04

What the Supreme Court's EPA ruling means for air pollution — and your health

2022-07-07

When the Supreme Court decided West Virginia v. EPA last week, most of the response was focused on the ruling's impact on the government's regulatory power over carbon emissions. The decision limited the EPA from making certain broad regulatory decisions — such as implementing a cap-and-trade program — to control greenhouse emissions from power plants under the authority of the Clean Air Act. While the ruling didn't get rid of the EPA's authority to regulate greenhouse gas emissions, as many environmentalists feared the Court might, it still limits the agency's overall policymaking power.

Climate action is the main victim, but fossil fuel power plants emit more than just CO2. They also emit air pollutants such as nitrogen oxides, sulfur oxides, and particulate matter. Conventional air pollution has damaging effects on health, life expectancy, cognition, productivity, and infant mortality. It's a risk factor for heart disease, cancer, respiratory infections, and other major causes of death. Even small increases in air pollution lead to negative health consequences. And as bad as it is now, scientists are constantly learning that air pollution is even worse than we thought.

How bad? The WHO updated its guidelines in 2021 to take into account the most recent findings, and under these new, tighter suggested limits, most of the US is currently breathing unhealthy levels of pollution.

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Since the new Supreme Court ruling curtails the EPA from implementing "generation shifting" measures that are proven to reduce both CO2 and air pollution, it has implications for health as well as the climate. Regulations and policies that accelerate the transition from coal and gas to renewable energy sources are doubly beneficial, and limiting the power of the EPA to do this — now and in future — will thus be doubly detrimental.

Read More

Vox, 7-07-22

https://www.vox.com/future-perfect/2022/7/7/23192182/air-pollution-west-virginia-epa-environment-particulate-pollution

Why are they called 'forever chemicals,' and other things to know about PFAS

2022-07-07

Residents of rural Central Massachusetts were shocked to learn that a composting facility likely spread toxic 'forever chemicals' known as PFAS into their drinking water, according to state officials.

They're not alone. The state has identified dangerous levels of the compounds in 84 community water systems across the Commonwealth.

The chemicals have been linked to a slew of health problems, even in tiny quantities.

Here's what you need to know about PFAS.

What are PFAS?

The term PFAS refers to a class of manmade per- and polyfluoroalkyl compounds that have been around since the 1940s. Since they resist heat, oil, stains, grease, and water, manufacturers use them in everything from cosmetics and cookware to yoga pants and firefighting foam. They're also found in construction materials and at airports and military installations.

"PFAS is virtually everywhere," said Carol Gregory, senior vice president of communications and marketing at Boston-based Conservation Law Foundation.

PFAS earned the alarming nickname "forever chemicals" because they don't break down easily in the environment. Due to their chemical makeup, they can stay intact for thousands of years.

"When it is dumped, it stays there," said Kyla Bennett, director of Public Employees for Environmental Responsibility in New England.

That's a huge problem for human health, because PFAS are highly toxic. Scientists have linked them to high cholesterol, hormone disruption, immune deficiency, and several cancers.

Read More

Boston Globe, 7-07-22

https://www.bostonglobe.com/2022/07/07/science/why-are-they-called-forever-chemicals-other-things-know-about-pfas/

EUROPE

4 key questions on the EU's shift to more sustainable chemicals

2022-07-07

The broad policy goal has a lot of support — underlined by the recent report from the European Environment Agency finding that exposure to pollution causes over 10 percent of all cancer cases in Europe.

But while green groups urge faster action and a far tighter regulatory regime, industry is calling for caution, warning that badly framed rules could hobble innovation and of unintended consequences for innovation and consumer satisfaction.

Those differences were on stark display at a POLITICO working group, where policymakers, industry leaders and NGOs debated the path to making chemicals more sustainable.

1. Grouping

A key friction point is grouping — the term for restricting or banning substances posing similar hazards, risks or functions instead of going one-by-one.

The aim is to make regulating chemicals simpler and quicker, and to ensure chemicals manufacturers can't replace one dangerous, banned substance with another similarly dodgy chemical — as has happened in the past.

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But that's worrying the European chemicals industry; while companies aren't objecting to the method itself, they do hold strong opinions on how such groups should be defined. They warn chemicals can have fundamental differences in properties and related behaviors, and that grouping could lead to broader-than-needed restrictions.

"The groups need to make sense," said Marco Mensink, head of the European Chemical Industry Council (Cefic). If the approach is too wide, then industry will be forced to push for reams of exemptions. "The whole system will go down and get clogged by derogations," he said.

Green groups have an answer for that: Don't allow derogations, said ClientEarth's Apolline Roger.

"I must say I'm surprised because the chemical industry is the best expert I know on grouping," added European Environmental Bureau policy expert Tatiana Santos, who pointed out that the industry has long registered chemicals for use on the EU market by group.

The European Commission is sticking with the idea of grouping, but is aware of the pressure surrounding opt-outs.

"We have to find a good combination between grouping and derogations," said Giuseppe Casella from the EU executive's industry and internal market department.

2. Essential use

Another contentious area is "essential use" — a concept which is supposed to ensure that harmful chemicals are only allowed if they are essential for health and safety or are critical for the functioning of society and if there are no alternatives.

Read More

Politico, 7-07-22

https://www.politico.eu/article/chemicals-strategy-for-sustainability-europe-4-key-questions/

Tests on 387 bats from five species found that all were exposed to high levels of poly-chlorinated biphenyls and organochlorine insecticides, legacy pollutants that have long been banned

Bats in Germany are riddled with pesticides and toxic pollutants

2022-07-06

Bats across Germany are riddled with residues of pesticides and persistent organic pollutants, according to the largest study to sample such exposure in a European bat population.

Christoph Müller at Ludwig-Maximilians University of Munich and his colleagues collected 387 dead insect-eating bats from five species: serotine bats (Eptesicus serotinus), greater mouse-eared bats (Myotis myotis), common noctules (Nyctalus noctule), common pipistrelles (Pipistrellus pipistrellus) and brown long-eared bats (Plecotus auratus). They tested their livers for 209 different compounds.

Read More

New Scientist, 6-07-22

https://www.newscientist.com/article/2327533-bats-in-germany-are-riddled-with-pesticides-and-toxic-pollutants

Italy has declared a state of emergency because of drought: 'There is no doubt that climate change is having an effect,' the prime minister said

2022-07-05

The Italian government declared a state of emergency on Monday in five regions because of a drought caused by lack of rain and rising temperatures.

To help the regions that have been especially hard hit, Italy is sending $37.5 million in relief funds distributed to the Emilia-Romagna, Friuli Venezia Giulia, Lombardy, Piedmont and Veneto regions, according to a statement by the Italian government.

"For the Po basin, this is the most serious water crisis of the last 70 years, according to analysis by the Po River District Basin Authority," Prime Minister Mario Draghi said on Thursday, in a translation of the statement.

The Tiber River, which flows through central Italy and Rome and is seen flowing under the famous Vittorio Emanuele II bridge in the image above, is also running at very low levels.

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CNBCm 5-7-22

https://www.cnbc.com/2022/07/05/italy-declared-a-state-of-emergency-because-of-drought-in-the-po-river.html

INTERNATIONAL

U.N. Ocean Conference ends with promises. Is a sea change coming?

2022-07-01

The United Nations Oceans Conference (UNOC) concluded on July 1 in Lisbon after a full five days of discussions and events focused on achieving a shared goal: U.N. Sustainable Development Goal No. 14 (SDG14), which aims to protect life below water. While representatives of governments, NGOs and other entities made hundreds of conservation commitments, experts say that there is still a lot of work to be done to protect our oceans.

SDG14 has been divided into 10 targets: reduce marine pollution; protect and restore ecosystems; reduce ocean acidification; ensure that fishing is done sustainably; conserve coastal and marine areas; end subsidies that contribute to harmful fishing practices; increase economic benefits from the sustainable use of marine resources; increase scientific knowledge, research and technology for ocean health; support small-scale fishers; and implement and enforce international law pertaining to the sea. Some of the targets were meant to be achieved in 2020, whereas others are to be addressed by 2030.

Peter Thomson, the U.N. secretary-general's special envoy for the ocean, said during a press briefing on June 25 that achieving these goals was essential for "our survival on the planet."

Read More

Mongabay, 1-07-22

https://news.mongabay.com/2022/07/u-n-ocean-conference-ends-with-promises-is-a-sea-change-coming/

REACH Update

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ECHA - Updated support for notifiers using system-to-system service

2022-07-06

An updated application programming interface (S2S API) will be launched for our system-to-system submission service on 18 July 2022.

A new web page is now available to support companies wanting to use our S2S submission service. The service is currently available for poison centre and SCIP notifiers but will be extended to classification and labelling notifiers in July's release. Our LinkedIn group has also been expanded to welcome new stakeholders.

Subscribe to keep up to date with our news on the system-to-system service.

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ECHA, 6-07-22

https://echa.europa.eu/es/view-article/-/journal_content/title/9109026-193

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Janet's Corner

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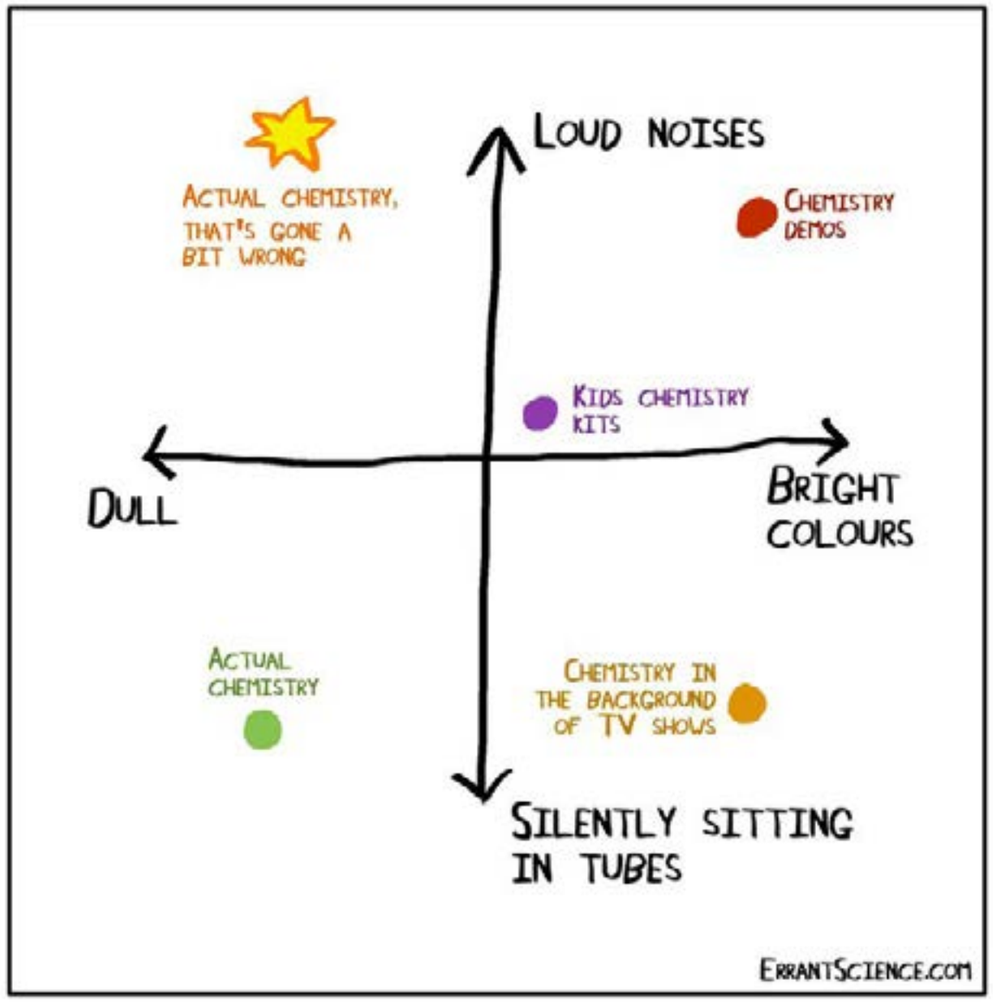
Chemistry 101

2022-07-15



https://twitter.com/ErrantScience/status/1543267164840394752

Naphthalene

2022-07-15

Naphthalene is an organic compound with the formula $C_{10}H_8$. It is the simplest polycyclic aromatic hydrocarbon, and is a white crystalline solid, which is flammable with a characteristic odour that is detectable at concentrations as low as 0.08 ppm by mass. As an aromatic hydrocarbon, naphthalene's structure consists of a fused pair of benzene rings. Naphthalene is the most abundant component of coal tar, which is the liquid by-product of the distillation of coal into coke for use as a smokeless fuel. In addition, naphthalene is produced upon the burning of organic material, such as fossil fuels, wood and tobacco, and is present in exhaust emissions and cigarette smoke. [1,2]

USES [1]

Naphthalene is used mainly as a precursor in producing other chemicals. The single largest use of naphthalene is the industrial production of phthalic anhydride, although more phthalic anhydride is made from o-xylene. Other naphthalene-derived chemicals include alkyl naphthalene sulphonate surfactants, and the insecticide 1-naphthyl-N-methylcarbamate (carbaryl). Naphthalenes substituted with combinations of strongly electron-donating functional groups, such as alcohols and amines, and strongly electron-withdrawing groups, especially sulfonic acids, are intermediates in the preparation of many synthetic dyes. The hydrogenated naphthalenes tetrahydronaphthalene (tetralin) and decahydronaphthalene (decalin) are used as low-volatility solvents. In addition, naphthalene is used in the synthesis of 2-naphthol, a precursor for various dyestuffs, pigments, rubber processing chemicals and other miscellaneous chemicals and pharmaceuticals. Naphthalene sulfonic acids are used in the manufacture of naphthalene sulphonate polymer plasticisers (dispersants), which are used to produce concrete and plasterboard (wallboard or drywall). They are also used as dispersants in synthetic and natural rubbers, and as tanning agents (syntans) in leather industries, agricultural formulations (dispersants for pesticides), dyes and as a dispersant in lead–acid battery plates. Naphthalene sulphonate polymers are produced by reacting naphthalene with sulphuric acid and then polymerising with formaldehyde, followed by neutralisation with sodium hydroxide or calcium hydroxide. These products are commercially sold in solution (water) or dry powder form. Alkyl naphthalene sulphonates (ANS) are used in many industrial applications as nondetergent wetting agents that effectively disperse colloidal systems in aqueous media. The major commercial applications are in the agricultural chemical industry, which uses ANS for wettable powder and wettable granular (dry-flowable) formulations, and the textile and fabric industry, which utilises the wetting and defoaming properties of ANS for bleaching and dyeing operations. The most familiar use of naphthalene is as a household fumigant, such as in mothballs although 1,4-dichlorobenzene (or p-dichlorobenzene) is now more widely used. In a sealed container containing naphthalene pellets, naphthalene vapours build up to levels toxic to both the adult and larval forms of many moths that attack textiles. Other fumigant uses of naphthalene include use in soil as a fumigant pesticide, in attic spaces to repel animals and insects, and in museum storage-drawers and cupboards to protect the contents from attack by insect pests. Naphthalene is also used in pyrotechnic special effects such as the generation of black smoke and simulated explosions. In the past, naphthalene was administered orally to kill parasitic worms in livestock. Naphthalene and its alkyl homologues are the major constituents of creosote. Naphthalene is used in engineering to study heat transfer using mass sublimation.

Naphthalene is an organic compound with the formula C10H8.

SOURCES & ROUTES OF EXPOSURE [3]

Exposure to naphthalene can occur in the following ways:

- Breathing low levels in outdoor air.
- Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.
- Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.
- Drinking water from contaminated wells.
- Touching fabrics that are treated with moth repellents containing naphthalene.
- Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

HEALTH RISKS [4]

Acute Effects

Acute exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with haemolytic anaemia, damage to the liver, and, in infants, neurological damage. Symptoms of acute exposure

include headache, nausea, vomiting, diarrhoea, malaise, confusion, anaemia, jaundice, convulsions, and coma. Cataracts have been reported in humans acutely exposed to naphthalene by inhalation and ingestion.

Chronic Effects (Noncancer)

Chronic exposure of workers to naphthalene has been reported to cause cataracts and retinal haemorrhage. Chronic inflammation of the lung, chronic nasal inflammation, hyperplasia of the respiratory epithelium in the nose, and metaplasia of the olfactory epithelium were reported in mice chronically exposed to naphthalene via inhalation. Rats, rabbits, and mice chronically exposed to naphthalene via ingestion have developed cataracts and degeneration of the retina. EPA has calculated a Reference Concentration (RfC) of 0.003 milligrams per cubic meter (mg/m3) for naphthalene based on nasal effects in mice. The Reference Dose (RfD) for naphthalene is 0.02 milligrams per kilogram body weight per day (mg/kg/d) based on decreased body weight in male rats.

Reproductive/Developmental Effects

Haemolytic anaemia has been reported in infants born to mothers who "sniffed" and ingested naphthalene (as mothballs) during pregnancy. The mothers themselves were anaemic, but to a lesser extent than the infants.

Cancer Risk

Workers occupationally exposed to vapours of naphthalene and coal tar developed laryngeal carcinomas or neoplasms of the pylorus and caecum. However, this study is inadequate because there were no controls, exposure levels were not determined, and subjects were exposed to complex mixtures containing other demonstrated carcinogens. Di-, tri-, and tetramethyl naphthalene contaminants of coal tar were found to be carcinogenic when applied to the skin of mice, but naphthalene alone was not. EPA has classified naphthalene as a Group C, possible human carcinogen.

SAFETY [5]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

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- Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
- 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. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Handling & Storage

- Keep naphthalene locked up and away from heat. Flammable materials should be stored in a separate safety storage cabinet or room.
- Keep away from sources of ignition.
- Keep container tightly closed and dry.
- Keep in a cool, well-ventilated place.
- Ground all equipment containing material.
- Do not ingest.
- Do not breathe dust.
- Avoid contact with eyes
- Wear suitable protective clothing
- In case of insufficient ventilation, wear suitable respiratory equipment
- If ingested, seek medical advice immediately and show the container or the label.
- Keep away from incompatibles such as oxidising agents.

Exposure Controls & Personal Protection

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection

Use the following personal protective equipment when handling naphthalene:

- Splash goggles
- Lab coat
- Dust respirator (be sure to use an approved/certified respirator or equivalent)
- Gloves

Personal Protection in Case of a Large Spill:

- Splash goggles
- Full suit
- Dust respirator
- Boots
- Gloves
- A self contained breathing apparatus should be used to avoid inhalation of the product.

Note: Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

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REGULATION

United States [6]

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
OSHA Permissible Exposure Limit (PEL) - General Industry See 29 CFR 1910.1000 Table Z-1	10 ppm (50 mg/m³) TWA	HE3	Cataracts, jaundice, bloody urine, kidney and liver damage
		HE7	Headache, tiredness, confusion Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and skin irritation
OSHA PEL - Construction Industry See 29 CFR 1926.55 Appendix A	10 ppm (50 mg/m³) TWA	HE3	Cataracts, jaundice, bloody urine, kidney and liver damage
		HE7	Headache, tiredness, confusion Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and skin irritation

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
OSHA PEL - Shipyard Employment See 29 CFR 1915.1000 Table Z-Shipyards	10 ppm (50 mg/m^3) TWA	HE3	Cataracts, jaundice, bloody urine, kidney and liver damage
		HE7	Headache, tiredness, confusion Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and skin irritation Target organs: Eyes, skin
National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL)	10 ppm (50 mg/m^3) TWA 15 ppm (75 mg/m^3) STEL	HE3	Jaundice, blood in urine, renal shutdown, optical neuritis, corneal damage
		HE7	Headache, confusion, excitement Target organs: Brain, central nervous system
		HE14	Eye irritation

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Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2001)*	10 ppm (52 mg/m^3) TWA 15 ppm (79 mg/m^3) STEL Skin; A4	HE3	Ocular toxicity (cataracts, optical neuritis, lens opacities, retinal degeneration), jaundice, renal failure
		HE7	Headache Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and respiratory tract irritation
CAL/OSHA PELs	10 ppm (50 mg/m^3) TWA 15 ppm (75 mg/m^3) STEL	HE3	Ocular toxicity (cataracts, optical neuritis, lens opacities, retinal degeneration), jaundice, renal failure
		HE7	Headache Target organs: Brain, central nervous system
		HE12	Haemolytic anaemia
		HE14	Marked eye and respiratory tract irritation

Australia [7]

Safe Work Australia: For naphthalene, the eight-hour time weighted average (TWA) exposure limit is 10 ppm or 52mg/m3. The short term exposure limit (STEL) concentration should not to exceed 15ppm or 79mg/m3.

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Cancer drug pulls surprising double duty to treat muscular dystrophy

2022-07-03

Duchenne Muscular Dystrophy (DMD) is a debilitating genetic disorder that eventually leaves patients in a wheelchair. In a new study, researchers have found that an existing cancer drug shows promise in slowing the progress of DMD by changing the type of muscle fibers to be more resilient.

DMD occurs as the result of a gene mutation on an X chromosome, which reduces the production of a protein called dystrophin. Without it, muscle cells become fragile and easily damaged, leaving patients with progressively weaker muscle function. Eventually, the disease progresses to muscles involved in heart and lung function, resulting in a shortened life expectancy.

While there's currently no cure, treatments to slow the progression of the disease are in development, such as drug combinations or boosting a related muscle-strengthening protein. Gene therapy could one day correct the disorder, with experiments on mice, dogs and pigs proving promising.

In the meantime, researchers at the University of British Columbia (UBC) have identified an existing drug that seems to slow the progression of DMD. The drug belongs to a group known as CSF1R inhibitors, which are already approved for use in humans to treat some forms of cancer by blocking a receptor that's overexpressed in tumor cells.

Funnily enough, the researchers discovered the role of CSF1R inhibitors in DMD by accident. These drugs also work to deplete microglia, the resident macrophages in the central nervous system, which has been explored as a way to "reset" the population of these cells. In this case, the UBC team was investigating the role of these macrophages on muscle regeneration. But when they depleted the macrophages of mice, they found that the animals' muscle fibers surprisingly changed into a type that's more resistant to the damage induced by muscular dystrophy.

"Many people will have heard that there are different types of muscle fibers, including fast-twitch and slow-twitch muscles," said Fabio Rossi, senior author of the study. "By administering this drug, we observed that the muscle fibers actually started to transition to a slower-twitch type that is more resistant to damage caused by muscle contractions."

"By administering this drug, we observed that the muscle fibers actually started to transition to a slower-twitch type that is more resistant to damage caused by muscle contractions."

To investigate further, the researchers tested the drug on mice with DMD, and found that within a few months treated mice had a higher percentage of damage-resistant muscle fibers compared to control mice. They were able to perform physical activities like running on a treadmill better too, with the team describing the improvement to their muscle resiliency as "profound."

While more work is needed before this treatment could be used in humans, the fact that CSF1R inhibitors are already in use in humans for other illnesses should speed up development.

"Developing a new drug can be a long process," says Rossi. "But with the safety profile for this drug already being proven in human studies, it could mean we're on a fast track to a new treatment for muscular dystrophy."

The research was published in the journal Science Translational Medicine.

New Atlas, 3 July 2022

https://newatlas.com

Large Hadron Collider revs up to unprecedented energy level

2022-07-04

Ten years after it discovered the Higgs boson, the Large Hadron Collider is about to start smashing protons together at unprecedented energy levels in its quest to reveal more secrets about how the universe works.

The world's largest and most powerful particle collider started back up in April after a three-year break for upgrades in preparation for its third run.

From Tuesday it will run around the clock for nearly four years at a record energy of 13.6 trillion electronvolts, the European Organization for Nuclear Research (CERN) announced at a press briefing last week.

It will send two beams of protons—particles in the nucleus of an atom—in opposite directions at nearly the speed of light around a 27-kilometer (17-mile) ring buried 100 meters under the Swiss-French border.

The resulting collisions will be recorded and analyzed by thousands of scientists as part of a raft of experiments, including ATLAS, CMS, ALICE and LHCb, which will use the enhanced power to probe dark matter, dark energy and other fundamental mysteries.

1.6 billion collisions a second

After this run, the collider will come back in 2029 as the High-Luminosity LHC, increasing the number of detectable events by a factor of 10.

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"We aim to be delivering 1.6 billion proton-proton collisions per second" for the ATLAS and CMS experiments, CERN's head of accelerators and technology Mike Lamont said.

This time around the proton beams will be narrowed to less than 10 microns—a human hair is around 70 microns thick—to increase the collision rate, he added.

The new energy rate will allow them to further investigate the Higgs boson, which the Large Hadron Collider first observed on July 4, 2012.

Compared to the collider's first run that discovered the boson, this time around there will be 20 times more collisions.

The discovery revolutionized physics in part because the boson fit within the Standard Model—the mainstream theory of all the fundamental particles that make up matter and the forces that govern them.

However several recent findings have raised questions about the Standard Model, and the newly upgraded collider will look at the Higgs boson in more depth.

"The Higgs boson is related to some of the most profound open questions in fundamental physics today," said CERN director-general Fabiola Gianotti, who first announced the boson's discovery a decade ago.

Compared to the collider's first run that discovered the boson, this time around there will be 20 times more collisions.

"This is a significant increase, paving the way for new discoveries," Lamont said.

Joachim Mnich, CERN's head of research and computing, said there was still much more to learn about the boson.

"Is the Higgs boson really a fundamental particle or is it a composite?" he asked.

"Is it the only Higgs-like particle that exists—or are there others?"

Joachim Mnich, CERN's head of research and computing said there was still much more to learn about the Higgs boson.

'New physics season'

Past experiments have determined the mass of the Higgs boson, as well as more than 60 composite particles predicted by the Standard Model, such as the tetraquark.

But Gian Giudice, head of CERN's theoretical physics department, said observing particles is only part of the job.

"Particle physics does not simply want to understand the how—our goal is to understand the why," he said.

Among the Large Hadron Collider's nine experiments is ALICE, which probes the matter that existed in the first 10 microseconds after the Big Bang, and LHCf, which uses the collisions to simulate cosmic rays.

After this run, the collider will come back in 2029 as the High-Luminosity LHC, increasing the number of detectable events by a factor of 10.

Beyond that, the scientists are planning a Future Circular Collider—a 100-kilometer ring that aims to reach energies of a whopping 100 trillion electronvolts.

But for now, physicists are keenly awaiting results from the Large Hadron Collider's third run.

"A new physics season is starting," CERN said.

Phys Org, 4 July 2022

https://phys.org

Stunning new Webb images: baby stars, colliding galaxies and hot exoplanets

2022-07-12

The views of the Universe just keep getting better. NASA's US$10-billion James Webb Space Telescope released four new scientific images on 12 July, including newborn stars sparkling through dramatic 'cliffs' of gas, and galaxies interacting in an intricate cosmic dance. A day earlier, astronomers had marvelled at its very first image, a mind-boggling deep dive into the distant Universe.

Webb observes the cosmos in infrared wavelengths, which gives it a different view from that of many other observatories, such as the Hubble Space Telescope. Webb's 6.5-metre-wide mirror is the largest ever launched into space, and the combination of the large mirror and its infrared detection capabilities allow Webb an unprecedented view of many astronomical phenomena.

These include stars and shock waves generated by collisions in a group of five galaxies known as Stephan's Quintet, 90 million parsecs away in the constellation Pegasus. The images that Webb collected of this galactic grouping reveal millions of young stars forming as gas and dust collide, as well as sweeping tails left by one of the galaxies, NGC 7318B, as it storms its way through the cluster. "It really shows the type of interaction that drives the evolution of galaxies," says Giovanna Giardino, an astronomer with the European Space Agency.

And that's not all. "For me, what was surprising about Stephan's Quintet was just how many galaxies are in the background," says Jane Rigby, Webb's operations project scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

Other cosmic action appears in a new Webb image of the Carina Nebula, a star-forming region around 2,300 parsecs away. Big, hot stars at the nebula's centre blast it with radiation, which carves out a gaseous cavity, ringed with dramatic peaks and valleys and dubbed the Cosmic Cliffs. Webb's infrared capabilities permitted it to peer through dust that often cloaks this view for other telescopes. The observatory also revealed brilliant pinpricks of light in the nebula, marking newborn stars. "There's just so much going on here — it's so beautiful," says Amber Straughn, an astrophysicist at Goddard.

On the opposite end of the stellar lifecycle is the Southern Ring Nebula, a glowing shell of gas and dust that was ejected by a star near the end of its life. Located around 770 parsecs away in the constellation Vela, the nebula displays rings of material, each ejected during a particular episode of the star's death throes. "You see what the star did just before it created this planetary nebula," says Klaus Pontoppidan, Webb's project scientist at the Space Telescope Science Institute in Baltimore, Maryland. "I find it fascinating because it's like geological layers, and you can see the history of its last moments."

Webb's high resolution enabled it to pick out intricate detail in these shells, as well as revealing a second star that orbits the main one. Together, those stars light the surrounding nebula like the Sun shining through patchy clouds.

Perhaps the least visually striking, but most scientifically compelling, image of NASA's release is a chemical analysis, or spectrum, of the

Perhaps the least visually striking, but most scientifically compelling, image of NASA's release is a chemical analysis, or spectrum, of the atmosphere of a distant planet known as WASP-96b.

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atmosphere of a distant planet known as WASP-96b. This planet is around half the mass of Jupiter but orbits its star in just 3.5 days, meaning that its surface is extremely hot. Webb observed the planet as it passed across the face of its star, such that the starlight travelled through the planet's atmosphere and enabled scientists to chemically analyse it. They spotted the fingerprint of water in the atmosphere of WASP-96b, suggesting that it is a truly steamy place.

The spectrum is "just spectacular", says Christopher Evans, the European Space Agency's Webb project scientist. "People have been trying to do [spectroscopy] from the ground for years … and suddenly it's just right there, and that's the first go."

It is the first of many exoplanet spectra that Webb will gather — in a research field that did not even exist when the telescope was being dreamed up, before any planets were known beyond the Solar System. And yet exoplanets now promise to be one of Webb's most significant areas of discovery. Studies of spectra from these planetary bodies can reveal how life-friendly other worlds might be. "We can use this tool to see something, because people want to know, when are we gonna see another Earth?" says John Mather, Webb's senior project scientist at Goddard.

All four of the telescope's instruments have been fully commissioned and are now doing science. Astronomers are thrilled to have this new and hugely capable observatory, which promises to enable discoveries across a wide range of astronomical phenomena. "We've got this humongous laboratory to learn about different aspects and different areas of the Universe," says Hannah Wakeford, an astronomer at the University of Bristol, UK.

Webb is a collaboration between NASA, the European Space Agency and the Canadian Space Agency. It launched in December after more than two decades of development, and observes the Universe from a spot in space on the other side of the Moon, 1.5 million kilometres from Earth.

Nature, 12 July 2022

https://nature.com

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Asthmatics may soon breathe easier thanks to new breakthrough

2022-07-04

New research led by Edith Cowan University has made an important discovery that could lead to more effective treatments for the world's 262 million asthma sufferers.

A study led by Dr. Stacey Reinke (ECU) and Dr. Craig Wheelock (Karolinska Institute, Sweden) found severe asthmatics have a distinct biochemical (metabolite) profile detectable in their urine, compared to mild-to-moderate asthmatics and healthy individuals.

Researchers analyzed urine samples from more than 600 participants across 11 countries as part of the U-BIOPRED study, a Europe-wide initiative to identify and better understand different sub-types of severe asthma.

The research team discovered a specific type of metabolite, called carnitines, decreased in severe asthmatics.

Carnitines play an important role in cellular energy generation and immune responses.

Further analyses found carnitine metabolism was lower in severe asthmatics.

These new findings will help enable researchers work towards new, more effective therapies for asthmatics.

Can urine really tell us what is happening in the lungs?

A big problem for a lot of people

Dr. Reinke, from ECU's Center for Integrative Metabolomics and Computational Biology, said it is vital asthma treatment is improved.

"Asthma affects 2.7 million Australians and there were 417 asthma-related deaths in Australia in 2020," she said.

"Severe asthma occurs when someone's asthma is uncontrolled, despite being treated with high levels of medication and/or multiple medications.

"To identify and develop new treatment options, we first need to better understand the underlying mechanisms of the disease."

One way to do this is to examine the body's chemical profile, or 'metabolome', which provides a snapshot of a person's current physiological state and gives useful insight into disease processes.

"In this case, we were able to use the urinary metabolome of asthmatics to identify fundamental differences in energy metabolism that may represent a target for new interventions in asthma control," Dr. Reinke said.

Can urine really tell us what is happening in the lungs?

Dr. Reinke said it can be difficult and invasive to investigate the lungs directly—but fortunately they contain a lot of blood vessels.

"Therefore, any biochemical changes in the lungs can enter the blood stream, and then be excreted through the urine," she said.

"These are preliminary results, but we will continue to investigate carnitine metabolism to evaluate its potential as a new asthma treatment target."

"Urinary metabotype of severe asthma evidences decreased carnitine metabolism independent of oral corticosteroid treatment in the U-BIOPRED study" was published in the European Respiratory Journal.

Medical Xpress, 4 July 2022

https://medicalxpress.com

Methane much more sensitive to global heating than previously thought – study

2022-07-05

Methane is four times more sensitive to global warming than previously thought, a new study shows. The result helps to explain the rapid growth in methane in recent years and suggests that, if left unchecked, methane related warming will escalate in the decades to come.

The growth of this greenhouse gas – which over a 20 year timespan is more than 80 times as potent than carbon dioxide – had been slowing since the turn of the millennium but since 2007 has undergone a rapid rise, with measurements from the US National Oceanic and Atmospheric Administration recording it passing 1,900 parts a billion last year, nearly triple pre-industrial levels.

"What has been particularly puzzling has been the fact that methane emissions have been increasing at even greater rates in the last two years, despite the global pandemic, when anthropogenic sources were assumed to be less significant," said Simon Redfern, an earth scientist at Nanyang Technological University in Singapore.

Greenhouse gas has undergone rapid acceleration and scientists say it may be due to atmospheric changes

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About 40% of methane emissions come from natural sources such as wetlands, while 60% come from anthropogenic sources such as cattle farming, fossil fuel extraction and landfill sites. Possible explanations for the rise in methane emissions range from expanding exploration of oil and natural gas, rising emissions from agriculture and landfill, and rising natural emissions as tropical wetlands warm and Arctic tundra melts.

But another explanation could be a slowdown of the chemical reaction that removes methane from the atmosphere. The predominant way in which methane is "mopped up" is via reaction with hydroxyl radicals (OH) in the atmosphere.

"The hydroxyl radical has been termed the 'detergent' of the atmosphere because it works to cleanse the atmosphere of harmful trace gases," said Redfern. But hydroxyl radicals also react with carbon monoxide, and an increase in wildfires may have pumped more carbon monoxide into the atmosphere and altered the chemical balance. "On average, a carbon monoxide molecule remains in the atmosphere for about three months before it's attacked by a hydroxyl radical, while methane persists for about a decade. So wildfires have a swift impact on using up the hydroxyl 'detergent' and reduce the methane removal," said Redfern.

To understand what was driving the methane acceleration, Redfern and his colleague Chin-Hsien Cheng used four decades of methane measurements and analysed changes in the climate to identify how the availability of hydroxyl radicals might have changed and what impact the changing climate might have had on methane sources.

Their findings, published in the journal Nature Communications, suggest global heating is four times more influential in accelerating methane emissions than previously estimated, with rising temperatures helping to produce more methane (by speeding up microbe activity in wetlands for example), while at the same time slowing down the removal of methane from the atmosphere (with increasing numbers of wildfires reducing the availability of hydroxyl radicals in the upper atmosphere). "It was a really shocking result, and highlights that the effects of climate change can be even more extreme and dangerous than we thought," said Redfern.

"If the oxidative capacity of the air is also in trouble, as these results suggest, then we have a double-edged sword," said Euan Nisbet, an earth scientist at Royal Holloway, University of London, who led the UK's Global Methane Budget project and was not involved in the study. "That's a real worry because methane acceleration is perhaps the largest factor challenging our Paris agreement goals."

While carbon reduction needs to remain the main focus, Redfern and Cheng said methane cannot be ignored. Nisbet agreed, saying: "Much of the emission comes from recently industrialised or developing countries and they need help. What is needed is not money but good governance. We need to persuade China and India – the two biggest emitters – to join the global methane pledge and deal with their coalmine vents, crop waste fires and landfill emissions. And we need to look at Africa where methane emissions may be growing rapidly from growing population, widespread crop waste fires and landfills, and warming natural wetlands."

Meanwhile, reducing and preventing forest fires and biomass burning is also important. "The worry is that climate change may accelerate such risks, feeding back to accelerating atmospheric methane concentrations in a vicious circle," said Redfern.

The Guardian, 5 July 2022

https://theguardian.com

'Disturbing': weedkiller ingredient tied to cancer found in 80% of US urine samples

2022-07-09

More than 80% of urine samples drawn from children and adults in a US health study contained a weedkilling chemical linked to cancer, a finding scientists have called "disturbing" and "concerning".

The report by a unit of the Centers for Disease Control and Prevention (CDC) found that out of 2,310 urine samples, taken from a group of Americans intended to be representative of the US population, 1,885 were laced with detectable traces of glyphosate. This is the active ingredient in herbicides sold around the world, including the widely used Roundup brand. Almost a third of the participants were children ranging from six to 18.

Academics and private researchers have been noting high levels of the herbicide glyphosate in analyses of human urine samples for years. But the CDC has only recently started examining the extent of human exposure to glyphosate in the US, and its work comes at a time of mounting concerns and controversy over how pesticides in food and water impact human and environmental health.

"I expect that the realization that most of us have glyphosate in our urine will be disturbing to many people," said Lianne Sheppard, professor at the

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CDC study finds glyphosate, controversial ingredient found in weedkillers including popular Roundup brand, present in samples

University of Washington's department of environmental and occupational health sciences. Thanks to the new research, "we know that a large fraction of the population has it in urine. Many people will be thinking about whether that includes them."

Sheppard co-authored a 2019 analysis that found glyphosate exposure increases the risk of non-Hodgkin lymphoma, and also co-authored a 2019 scientific paper that reviewed 19 studies documenting glyphosate in human urine.

Both the amount and prevalence of glyphosate found in human urine has been rising steadily since the 1990s when Monsanto Co. introduced genetically engineered crops designed to be sprayed directly with Roundup, according to research published in 2017 by University of California San Diego School of Medicine researchers.

Paul Mills, the lead researcher of that study, said at the time there was "an urgent need" for a thorough examination of the impact on human health from glyphosate in foods people commonly consume.

More than 200 million pounds of glyphosate are used annually by US farmers on their fields. The weedkiller is sprayed directly over genetically engineered crops such as corn and soybeans, and also over non-genetically engineered crops such as wheat and oats as a desiccant to dry crops out prior to harvest. Many farmers also use it on fields before the growing season, including spinach growers and almond producers. It is considered the most widely used herbicide in history.

Residues of glyphosate have been documented in an array of popular foods made with crops sprayed with glyphosate, including baby food. The primary route of exposure for children is through the diet.

Monsanto and the company that bought it in 2018, Bayer, have maintained that glyphosate and Roundup products are safe, and that residues in food and in human urine are not a health risk.

They are at odds with many researchers and the International Agency for Research on Cancer, a unit of the World Health Organization, which classified glyphosate as a probable human carcinogen in 2015.

The US Environmental Protection Agency (EPA) has taken the opposite stance, classifying glyphosate as not likely to be carcinogenic. But last month a federal appeals court issued an opinion vacating the agency's safety determination and ordering the agency to give "further consideration" to evidence of glyphosate risks.

"People of all ages should be concerned, but I'm particularly concerned for children," said Phil Landrigan, who worked for years at the CDC and the EPA and now directs the Program for Global Public Health and the Common Good at Boston College.

"Children are more heavily exposed to pesticides than adults because pound-for-pound they drink more water, eat more food and breathe more air," Landrigan said. "Also, children have many years of future life when they can develop diseases with long incubation periods such as cancer. This is particularly a concern with the herbicide, glyphosate."

The new CDC data was released as part of the National Health and Nutrition Examination Survey (NHANES), research that is typically highly valued by scientists.

Cynthia Curl, Boise State University assistant professor of community and environmental health, said it was "obviously concerning" that a large percentage of the US population is exposed to glyphosate, but said it is still unclear how that translates to human health.

The Guardian, 9 July 2022

https://theguardian.com

Hunger really can make us feel 'hangry', study finds

2022-07-06

New scientific research has discovered that feeling hungry really can make us "hangry," with emotions such as anger and irritability strongly linked with hunger. Published in the journal PLOS ONE, the study is the first to investigate how hunger affects people's emotions on a day-to-day level.

Hangry, a portmanteau of hungry and angry, is widely used in everyday language but the phenomenon has not been widely explored by science outside of laboratory environments.

The new study, led by academics from Anglia Ruskin University (ARU) in the UK and the Karl Landsteiner University of Health Sciences in Austria, found that hunger is associated with greater levels of anger and irritability, as well as lower levels of pleasure.

The researchers recruited 64 adult participants from central Europe, who recorded their levels of hunger and various measures of emotional well-being over a 21-day period.

Hangry, a portmanteau of hungry and angry, is widely used in everyday language but the phenomenon has not been widely explored by science outside of laboratory environments.

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Participants were prompted to report their feelings and their levels of hunger on a smartphone app five times a day, allowing data collection to take place in participants' everyday environments, such as their workplace and at home.

The results show that hunger is associated with stronger feelings of anger and irritability, as well as lower ratings of pleasure, and the effects were substantial, even after taking into account demographic factors such as age and sex, body mass index, dietary behavior, and individual personality traits.

Hunger was associated with 37% of the variance in irritability, 34% of the variance in anger and 38% of the variance in pleasure recorded by the participants. The research also found that the negative emotions—irritability, anger, and unpleasantness—are caused by both day-to-day fluctuations in hunger, as well as residual levels of hunger measured by averages over the three-week period.

Lead author of the study Viren Swami, Professor of Social Psychology at Anglia Ruskin University (ARU), said: "Many of us are aware that being hungry can influence our emotions, but surprisingly little scientific research has focused on being 'hangry.'"

"Ours is the first study to examine being 'hangry' outside of a lab. By following people in their day-to-day lives, we found that hunger was related to levels of anger, irritability, and pleasure.

"Although our study doesn't present ways to mitigate negative hunger-induced emotions, research suggests that being able to label an emotion can help people to regulate it, such as by recognizing that we feel angry simply because we are hungry. Therefore, greater awareness of being 'hangry' could reduce the likelihood that hunger results in negative emotions and behaviors in individuals."

The field work was carried out by Stefan Stieger, Professor of Psychology at Karl Landsteiner University of Health Sciences. Professor Stieger said: "This 'hangry' effect hasn't been analyzed in detail, so we chose a field-based approach where participants were invited to respond to prompts to complete brief surveys on an app. They were sent these prompts five times a day at semi-random occasions over a three-week period.

"This allowed us to generate intensive longitudinal data in a manner not possible with traditional laboratory-based research. Although this approach requires a great deal of effort—not only for participants but

also for researchers in designing such studies—the results provide a high degree of generalizability compared to laboratory studies, giving us a much more complete picture of how people experience the emotional outcomes of hunger in their everyday lives."

Medical Xpress, 6 July 2022

https://medicalxpress.com

World's first commercial sand battery begins energy storage in Finland

2022-07-05

Wind and solar power are intermittent, generating power when it's available rather than when it's needed, so the green energy transition will require huge amounts of energy storage. This could end up taking many forms, from conventional lithium-based "big battery" installations, to flow batteries, silicon phase-change batteries, molten salt batteries, iron-air batteries, gravity batteries, carbon dioxide expansion batteries, and other more unusual ideas like buoyancy batteries.

Each has its own advantages and disadvantages in terms of efficiency, size, location, installation costs, operating costs, input and output power ratings, longevity and how long it can store the energy for. That's good, since different solutions will fill different needs – some backing up the power grid during instantaneous demand spikes, others smoothing out the mismatched daily curves between demand and renewable supply, and others still helping to address seasonal supply drops, like when solar drops off through the winter.

Here's another for the pile, coming out of Finland. Polar Night Energy says it's just opened its first commercial sand battery at the premises of "new energy" company Vatajankoski, a few hours out of Helsinki.

This is a thermal energy storage system, effectively built around a big, insulated steel tank – around 4 metres (13.1 ft) wide and 7 metres (23 ft) high – full of plain old sand. When this sand is heated up, using a simple heat exchanger buried in the middle of it, this device is capable of storing an impressive 8 megawatt-hours of energy, at a nominal power rating of 100 kW, with the sand heated to somewhere around 500-600 degrees Celsius (932-1112 °F).

When it's needed, the energy is extracted again as heat in the same way. Vatajankowski is using this stored heat, in conjunction with excess heat

A new type of battery being put to use in Finland is exploring the potential of sand as an energy storage medium

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from its own data servers, to feed the local district heating system, which uses piped water to transmit heat around the area. It can then be used to heat buildings, or swimming pools, or in industrial processes, or in any other situation that requires heat.

This helps make it extremely efficient, the company tells Disruptive Investing in a video interview. "It's really easy to convert electricity into heat," says Polar Night CTO Markku Ylönen. "But going back from heat to electricity, that's where you need turbines and more complex things. As long as we're just using the heat as heat, it stays really simple." The company claims an efficiency factor up to 99 percent, a capability to store heat with minimal loss for months on end, and a lifespan in the decades.

There's nothing special about the sand – the company says it just needs to be dry and free from combustible debris. Indeed, the company sees it as a super-low or even zero-cost storage medium. The whole thing's so simple and cheap that Polar Night Energy claims the setup costs are less than €10 (US$10.27) per kilowatt-hour, and it runs itself in a fully-automated fashion, using no consumables, at a minimal cost as well.

The company says it'll scale up, too, with installations around 20 gigawatt-hours of energy storage making hundreds of megawatts of nominal power, and the sand heated as far as 1,000 °C (1,832 °F) in certain designs. It's possible to create bulk underground storage facilities out of disused mine shafts, if they're the right shape. There are no high-pressure vessels needed, and the biggest cost involved is often the pipework.

The business name Polar Night is of course a reference to the fact that parts of Northern Finland see no sun at all during the winter, since they're above the latitude (~68 degrees north) where there's no direct sun at all for weeks on end through the depths of winter. This sand battery, says the company, will have its greatest impact during periods like this, when its long-duration storage will keep buildings heated cheaply and cleanly through the freezing Finnish winter.

Indeed, the solid sand storage medium comes into its own here, since the design enables multiple 'zones' of energy storage within the sand. It's possible to build a system designed for longer-term heat storage toward the center of the cylinder of sand, but shorter-term repeated use cycles closer to the top surface or the outside. This would be impossible in a liquid medium like water or molten salt, since the liquids would constantly be mixing and moving.

It's fair to say this system will only find widespread use in areas with district-level heating. But there's a surprising amount of district heating going on. Nearly half of all Scandinavian homes incorporate some form of it, and it can be found in many other areas too, including Northern China and the USA.

As such, Mission Innovation's climate solutions framework has estimated estimated that deploying Polar Night's energy storage system to its full potential could replace enough carbon-burning heat sources to reduce annual greenhouse emissions by somewhere between 57 and 283 megatons of CO2 equivalent per year by 2030. That would be a pretty significant contribution.

New Atlas, 5 July 2022

https://newatlas.com

PFAS: Hard to escape in food, clothes, and makeup

2022-07-07

EHN.org, in partnership with the website Mamavation.com, spent the bulk of 2022 finding PFAS in scores of everyday products. Our findings suggest these troublesome chemicals are on our shelves, in our bodies, and almost impossible to avoid.

Surprisingly, many brands that tout clean and green credentials – like Lululemon, Burt's Bees, Trader Joe's – are contaminated with PFAS, according to our investigation. PFAS—a family of plastic additives that contribute to cancer, reproductive and immune system damages, elevated cholesterol, and other health issues—remain largely unregulated, leaving consumers to fend for themselves.

The collaboration between EHN.org and wellness community Mamavation looked for fluorine, an indicator of PFAS, short for per- and polyfluoroalkyl substances. We found contamination in clothing, food, and makeup products from popular brands like Lululemon, Old Navy, Burt's Bees, Whole Foods, and Trader Joe's.

It is not entirely clear what this exposure—especially from clothing—means for our health. But experts say it contributes to our overall load of PFAS.

The problem feels overwhelming, but you can act. Share our series with people in power that shape policy, learn about the brands and products

"Do you want a chemical on your athletic wear that is linked to metabolism woes and weight gain and vaccine issues?"

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with the highest levels, and subscribe to our daily newsletter where we will keep you informed of all the movement on PFAS pollution and regulation.

Some highlights

- Evidence of PFAS in 15 of 23 popular sports bras, and in eight of 32 workout pants and leggings—with fluorine levels as high as 284 parts per million (LulaRoe Leggings).
- Evidence of PFAS in 54 of 83 lipsticks, mascaras, and other beauty products tested—with fluorine levels as high as 865 ppm (Clove & Hallow Lip Velvet Liquid Lipstick).
- Evidence of PFAS in canola cooking oils, and pasta sauces.

"Every single woman who's working out in the United States, I promise if you ask her, "Do you want a chemical on your athletic wear that is linked to metabolism woes and weight gain and vaccine issues," [she] will say no," Leah Segedie, founder of eco-wellness and consumer safety blog Mamavation, which commissioned the testing, told EHN.

Testing for PFAS is tricky—for scientists, industry, and nonprofits like us.

Here are some important takeaways about testing and contamination

- Testing for PFAS—a family of 8,000 to 9,000 individual compounds—is expensive, hard, and imperfect. We used an accredited lab and, in testing some products more than once, found different levels for each test. There is no standardized test for checking products for PFAS.
- Many companies—especially clean beauty brands—expressed a desire for standardized, affordable testing.
- Some products, such as outdoor clothing, may have PFAS intentionally added for water or stain resistance. However, we found evidence that these "forever chemicals" can unintentionally contaminate consumer goods in many ways—including manufacturing lubricants and coatings, misidentified raw materials, even plastic packaging.

PFAS is so pervasive in society that many manufacturers cannot—or simply will not—get accurate information about what's in their products.

"Oftentimes, those suppliers don't know the answers to the questions you're asking even though they should be the expert, or they don't want to look for the answers because they don't want to tell you what it is," Lindsay Dahl, senior vice president at the clean cosmetics brand Beautycounter, told EHN. "Or they just flat out send you a piece of paper that says whatever you want it to say."

PFAS are largely unregulated in the U.S. and the bulk of attention remains on the chemicals in our drinking water, which experts suspect is the major exposure route. There are an estimated 40,000 U.S. sites that are potential PFAS sources, and state and federal data shows roughly 200 million Americans may have PFAS-contaminated water.

Bans and legislative movement

- Lawsuits target companies with PFAS in their products, especially in cosmetics. Toxin Free USA sued CoverGirl; Burt's Bees faces a class action lawsuit filed in February based on the Mamavation testing.
- Third-party certifications give consumers more knowledge. While a step in the right direction, researchers warn these remain imperfect with some allowing too many toxics in "passing" grades.
- In April, Starbucks announced it will eliminate PFAS from all U.S. packaging by the end of 2022. Burger King, Tim Hortons, Taco Bell, and McDonald's have all announced similar bans.
- Also in April, Washington state passed a bill to phase out PFAS in select consumer products by 2025. Maine banned the sale of PFAS in all products, including cosmetics, except when their use was "currently unavoidable," starting in 2030. California and Maryland banned the sale of any cosmetics with some PFAS starting in 2025.
- The EPA last month added five PFAS chemicals to its screening and risk assessment program.
- A House Committee recently approved the Federal PFAS Research Evaluation Act, which directs federal agencies to research and advance our understanding of PFAS.
- There's a federal bill in the works — "No PFAS in Cosmetics Act," introduced by Sen. Susan Collins, R-ME in the Senate and Rep. Debbie Dingell, D-MI, in the House.

Given our findings, and the glacial pace of federal action when it comes to toxic chemicals, this can all feel overwhelming.

But there are things you can do

- Learn the essentials about PFAS with our comprehensive guide.
- Put pressure on manufacturers by sharing this investigation and asking for evidence that products you're buying are PFAS-free.
- Sign up for Above the Fold, our free daily newsletter that gives subscribers the "need to know" news every morning on PFAS and other ongoing environmental threats.

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- Visit Mamavation and go to Product Investigations for suggestions on food, clothing, and makeup that appears PFAS-free.

Environmental Health News, 7 July 2022

https://www.ehn.org

Clinical trials for pig-to-human organ transplants inch closer

2022-07-06

In the months since physicians showed that it is possible to transplant pig organs into humans, researchers have been calling for US regulators to allow clinical trials to test such procedures thoroughly in people. Last week, during a two-day meeting of an advisory committee to the US Food and Drug Administration (FDA), agency officials and physicians discussed what regulators would need to move forwards. Most attendees agreed that human trials are needed to help answer the most pressing research questions about inter-species transplants, known as xenotransplants.

The data support the initiation of "small, focused" clinical trials with "appropriately selected patients", says Allan Kirk, a transplant surgeon at the Duke University School of Medicine in Durham, North Carolina, who presented at the meeting.

Researchers have repeatedly transplanted pig organs into non-human primates, such as baboons, with success. But these experiments don't simulate human trials perfectly. If the ultimate goal is to do transplants in people, human trials are needed, says Caroline Zeiss, a veterinary specialist at Yale School of Medicine in New Haven, Connecticut.

Such trials, she says, would help to answer a slew of questions, including what is the best cocktail of immunosuppressive drugs to give humans to help their bodies accept a pig organ, and how can physicians manage the risk that transplanted organs might harbour a pig virus. Researchers also want to know which pig breed is best suited for growing transplant organs, and how co-occurring health conditions, such as diabetes, could affect transplantation success.

Physicians see an urgent need for the trials: more than 100,000 people are waiting for organ transplants in the United States alone. Researchers have long hoped that xenotransplantation could help to meet demand and, therefore, save lives. "We have people dying each day waiting for organs," says Jay Fishman, a specialist in transplant infectious disease at

Physicians see an urgent need for the trials: more than 100,000 people are waiting for organ transplants in the United States alone.

Massachusetts General Hospital in Boston who participated in the FDA meeting.

A big question answered

Although there have so far been no formal human xenotransplant trials, physicians have performed a handful of the procedures in the past year, with the permission of institutional ethics boards. In late 2021, for instance, surgeons transferred genetically modified pig kidneys into two legally dead people who had no discernible brain function and were on ventilators. The kidneys functioned normally over the 54 hours of the test and seemed to produce urine1.

In January this year, a severely ill man became the first to receive a pig heart, during an operation in Baltimore, Maryland. (The man otherwise faced certain death, so the FDA granted a compassionate-use authorization for the procedure.)

The heart recipient recovered from the surgery, and his body did not reject the genetically modified organ, but he died two months later. Physicians later found traces of porcine cytomegalovirus (PCMV) in the pig heart and now think that the pathogen might have contributed to the man's death. An investigation is under way.

Fishman says it's thought that the virus doesn't infect human cells, but it has been linked with reduced survival times for non-human primates that received pig organs2. To get to the bottom of the mystery, more tests and trials are needed, researchers say.

Even though the heart-transplant recipient died, the surgery represents an enormous accomplishment, Kirk says. The science of xenotransplantation, he says, has advanced to the point that there is an answer to the biggest question — can a pig organ support life in a human who would otherwise die? And the answer is yes.

The high-profile transplants have "increased public awareness of the field" and have "made this an optimal time for public conversation" and clinical trials, said Wilson Bryan, director of the FDA's Office of Tissues and Advanced Therapies in Silver Spring, Maryland, at the meeting.

Reducing risks

But there are still many questions that must be answered before xenotransplantation can become standard clinical practice. During the advisory meeting, the FDA sought advice from committee members

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on how to improve screening for viruses — PCMV can linger silently in infected pigs — and how to reduce the risk of breeding pigs with viral infections. To be more comfortable with human trials, Zeiss said she wants to see validated tests that could eliminate the possibility that PCMV and other viruses are lurking in pigs bred as organ donors.

Companies such as Revivicor in Blacksburg, Virginia, owned by United Therapeutics, have been breeding pigs for use in xenotransplantation. They have been searching for the right combination of genetic modifications for their pigs to help ensure that humans' immune systems accept organs from the animals. These companies "have been creative making these pigs; hopefully they'll be creative testing them", said FDA investigator Deborah Hursh at the meeting.

Other panellists discussed whether it would be possible to develop a standard 'package' of immunosuppressive drugs for humans, and genetic modifications for pigs, to ensure success. Fishman said that there probably won't be one package that works for everyone. Instead, it will need to be tailored on the basis of the organ being transplanted and the recipient's condition, as is done in human-to-human organ transplants.

Researchers at the University of Alabama at Birmingham and the University of Maryland Medical Center in Baltimore have signalled their desire to begin xenotransplant clinical trials soon. The FDA hasn't publicly indicated what it will do with the advice collected during the meeting, but a 30 June report from The Wall Street Journal says that the agency is devising plans to allow trials.

Nature, 6 July 2022

https://nature.com

How viruses can change your body odor to attract mosquitoes

2022-07-04

An international team of researchers has discovered an incredible way some viruses can alter the smell of their host in order to attract mosquitoes and spread to the next person. The study revealed Dengue and Zika viruses can alter a host's skin microbiome to enhance the volume of odor molecules that draw in mosquitoes.

The new research arose from a simple observation. Odor is among a number of sensory cues that drive how mosquitoes select organisms to bite. And prior research has found mice infected with a malaria parasite generate distinct changes to their scent profiles. So, could viruses that rely on mosquitoes to spread, such as dengue or Zika, change the way their host smells in order to enhance their chances of transmission to the next person?

The first step in the research was simple – set a bunch of mosquitoes loose in chambers with infected and uninfected mice and see where they go. After several experiments the researchers did indeed observe greater volumes of mosquitoes moving towards mice infected with dengue or Zika.

About 20 different gaseous compounds were isolated from the infected mice. Testing each one individually the researchers discovered one chemical in particular attracted the most mosquitoes: acetophenone. Investigating the mice it was found those animals infected with dengue or Zika produced up to 10 times more acetophenone than uninfected mice.

"Similarly, we found that the odors collected from the armpits of dengue fever patients contained more acetophenone than those from healthy people," explained study co-author Penghua Wang, in a piece for The Conversation. "When we applied the dengue fever patient odors on one hand of a volunteer and a healthy person's odor on the other hand, mosquitoes were consistently more attracted to the hand with dengue fever odors."

The next step was to work out how the virus could be altering its host's production of acetophenone. The researchers suspected the odor molecule was being emitted through the skin of the host organism, and this process was mediated by bacteria on the skin.

It was found some viruses enhance their chances of spreading to new hosts by making their current host express odor molecules that attract mosquitoes

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"When we compared the skin bacteria compositions of infected and uninfected mice, we identified that a common type of rod-shaped bacteria, Bacillus, was a major acetophenone producer and had significantly increased numbers on infected mice," explained Wang. "This meant that the dengue and Zika viruses were able to change their host's odor by altering the microbiome of the skin."

Healthy skin produces an antimicrobial molecule called RELMα, and the researchers discovered infected mice had unusually low levels of this molecule. So it seems like the dengue and Zika viruses have developed a way to suppress a host's RELMα levels, allowing for Bacillus bacteria to grow unchecked and produce greater volumes of acetophenone, which in turn attracts more mosquitoes and helps the virus to spread to a new host.

The final stage of the study looked at whether this mosquito-attracting viral mechanism could be prevented. Here the researchers turned to isotretinoin, a derivative of vitamin A previously found to enhance production of RELMα.

Treating infected mice with isotretinoin worked, reducing levels of Bacillus bacteria on the skin and increasing levels of RELMα. When infected mice were treated with isotretinoin, mosquitoes were no more attracted to them than uninfected mice.

Wang said the next step is to test this mechanism in human patients infected with dengue or Zika. If this is all validated in humans then it is possible transmission of these mosquito-borne viral diseases could be reduced by a simple isotretinoin treatment. It may even be possible to lower the broader impact of these viruses in the long-term by increasing dietary supplements of vitamin A in regions that struggle with these diseases.

The new study was published in the journal Cell.

New Atlas, 4 July 2022

https://newatlas.com

Only seven percent of adults have good cardiometabolic health

2022-07-04

Less than 7 percent of the U.S. adult population has good cardiometabolic health, a devastating health crisis requiring urgent action, according to research led by a team from the Friedman School of Nutrition Science and

Policy at Tufts University in a pioneering perspective on cardiometabolic health trends and disparities published in the July 12 issue of the Journal of the American College of Cardiology. Their team also included researchers from Tufts Medical Center.

Researchers evaluated Americans across five components of health: levels of blood pressure, blood sugar, blood cholesterol, adiposity (overweight and obesity), and presence or absence of cardiovascular disease (heart attack, stroke, etc.). They found that only 6.8 percent of U.S. adults had optimal levels of all five components as of 2017-2018. Among these five components, trends between 1999 and 2018 also worsened significantly for adiposity and blood glucose. In 1999, 1 out of 3 adults had optimal levels for adiposity (no overweight or obesity); that number decreased to 1 out of 4 by 2018. Likewise, while 3 out of 5 adults didn't have diabetes or prediabetes in 1999, fewer than 4 out of 10 adults were free of these conditions in 2018.

"These numbers are striking. It's deeply problematic that in the United States, one of the wealthiest nations in the world, fewer than 1 in 15 adults have optimal cardiometabolic health," said Meghan O'Hearn, a doctoral candidate at the Friedman School and the study's lead author. "We need a complete overhaul of our healthcare system, food system, and built environment, because this is a crisis for everyone, not just one segment of the population."

The study looked at a nationally representative sample of about 55,000 people aged 20 years or older from 1999 to 2018 from the 10 most recent cycles of the National Health and Nutrition Examination Survey. The research team focused on optimal, intermediate, and poor levels of cardiometabolic health and its components, rather than just presence or absence of disease. "We need to shift the conversation, because disease is not the only problem," O'Hearn said. "We don't just want to be free of disease. We want to achieve optimal health and well-being."

The researchers also identified large health disparities between people of different sexes, ages, races and ethnicities, and education levels. For example, adults with less education were half as likely to have optimal cardiometabolic health compared with adults with more education, and Mexican Americans had one-third the optimal levels versus non-Hispanic White adults. Additionally, between 1999 and 2018, while the percentage of adults with good cardiometabolic health modestly increased among non-Hispanic White Americans, it went down for Mexican American, other Hispanic, non-Hispanic Black, and adults of other races.

The study also assessed "intermediate" levels of health—not optimal but not yet poor—including conditions like pre-diabetes, pre-hypertension, and overweight.

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"This is really problematic. Social determinants of health such as food and nutrition security, social and community context, economic stability, and structural racism put individuals of different education levels, races, and ethnicities at an increased risk of health issues," said Dariush Mozaffarian, dean of the Friedman School and senior author. "This highlights the other important work going on across the Friedman School and Tufts University to better understand and address the underlying causes of poor nutrition and health disparities in the U.S. and around the world."

The study also assessed "intermediate" levels of health—not optimal but not yet poor—including conditions like pre-diabetes, pre-hypertension, and overweight. "A large portion of the population is at a critical inflection point," O'Hearn said. "Identifying these individuals and addressing their health conditions and lifestyle early is critical to reducing growing healthcare burdens and health inequities."

The consequences of the dire state of health among U.S. adults reach beyond personal health. "Its impacts on national healthcare spending and the financial health of the entire economy are enormous," O'Hearn said. "And these conditions are largely preventable. We have the public health and clinical interventions and policies to be able to address these problems."

Researchers at the Friedman School work actively on many such solutions, O'Hearn said, including Food is Medicine interventions (using good nutrition to help prevent and treat illness); incentives and subsidies to make healthy food more affordable; consumer education on a healthy diet; and private sector engagement to drive a healthier and more equitable food system. "There are a lot of different avenues through which this can be done," O'Hearn said. "We need a multi-sectoral approach, and we need the political will and desire to do it."

"This is a health crisis we've been facing for a while," O'Hearn said. "Now there's a growing economic, social and ethical imperative to give this problem significantly more attention than it has been getting."

Medical Xpress, 4 July 2022

https://medicalxpress.com

Cloned mice created from freeze dried skin cells in world first

2022-07-06

Researchers have created cloned mice from freeze dried skin cells in a world first that aims to help conservationists revive populations of endangered species.

The breakthrough paves the way for countries to store skin cells from animals as an insurance policy, as the cells can be used to create clones that boost the species' genetic diversity if they become threatened with extinction in the future.

Many dwindling species suffer from inbreeding that drives up the risk of birth defects, but the loss of genetic diversity can also make animals more vulnerable to other threats, such as diseases, which exacerbate the pressures they face.

While scientists have used frozen cells to produce clones for conservation projects, the cells are kept in liquid nitrogen which is expensive and risky: if there are power outages or the liquid nitrogen is not regularly topped up, the cells melt and become unusable. Freeze dried sperm can also be used to create clones, but cannot be obtained from all animals.

"If these cells can be preserved without liquid nitrogen using freeze-drying technology, it allows genetic resources from around the world to be stored cheaply and safely," said Prof Teruhiko Wakayama who led the work at the University of Yamanashi in Japan. "Developing countries will be able to store their own valuable genetic resources in their own countries. Also, even in endangered species where only males survive, this technology can be used to create females to revive the species."

Breakthrough could help conservationists revive dwindling populations of endangered species

In the latest work, researchers froze dried skin cells from mouse tails and stored them for up to nine months before trying to create clones from them. The freeze-drying processes killed the cells, but the scientists found they could still create early stage cloned embryos by inserting the dead cells into mouse eggs that had their own nuclei removed.

These early stage mouse embryos, known as blastocysts, were used to create stocks of stem cells that were put through another round of cloning. The stem cells were inserted into mouse eggs emptied of their own nuclei, leading to embryos that surrogate mice carried to term. The first cloned mouse, named Dorami after a melon bread-loving robot in the Doraemon Manga series, was followed by 74 more. To check whether the clones had

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healthy fertility, nine females and three males were bred with normal mice. All the females went on to have litters.

Despite the achievement, the process is inefficient – freeze drying damaged DNA in the skin cells – and the success rate for creating healthy female and male mouse pups was only 0.2 to 5.4%. In some of the cells, the Y chromosome was lost, leading to female mice being born from cells obtained from male animals. "If the same treatment could be performed in endangered species where only males survived, it would be possible to produce females and naturally preserve the species, the authors write in Nature Communications.

The work comes as scientists prepare to nurture offspring from the world's first cloned black footed ferret, Elizabeth Ann, in an attempt to boost the species' genetic diversity. The animal was cloned from cells deep frozen in liquid nitrogen 35 years ago.

Dr Alena Pance at the University of Hertfordshire said being able to store genetic material is "extraordinarily important" to maintain samples of species and also their genetic variation. But she said it was "paramount" to show the freeze-dried cells could be stored indefinitely if they are to provide an effective long-term solution.

The Guardian, 6 July 2022

https://theguardian.com

Space elevator ride to the moon is feasible using today's technology

2022-07-06

Perhaps the biggest hurdle to humankind's expansion throughout the solar system is the prohibitive cost of escaping Earth's gravitational pull. So say Zephyr Penoyre from the University of Cambridge in the UK and Emily Sandford at Columbia University in New York.

The problem is that rocket engines work by jettisoning mass in one direction to generate thrust for a spacecraft in the other. And that requires huge volumes of propellant, which is ultimately discarded but also has to be accelerated along with the spacecraft.

The result is that placing a single kilogram into orbit costs in the region of tens of thousands of dollars. Getting to the moon and beyond is even more expensive. So there is considerable interest in finding cheaper ways into orbit.

A conventional space elevator would make a complete rotation every day, in line with Earth's rotation. But the moon-based spaceline would orbit just once a month—a much slower rate with correspond-ingly lower forces.

One idea is to build a space elevator—a cable stretching from Earth to orbit that provides a way to climb into space. The big advantage is that the climbing process can be powered by solar energy and thus would require no onboard fuel.

But there is a big problem too. Such a cable would need to be incredibly strong. Carbon nanotubes are a potential material if they can ever be made long enough. But options available today are just too feeble.

Enter Penoyre and Sandford, who have revisited the idea with a twist. They say their version of a space elevator, which they call a spaceline, could be built with materials that are commercially available today.

First some background. A space elevator as conventionally conceived would consist of a cable anchored on the ground and extending beyond geosynchronous orbit, some 42,000 kilometers (26,098 miles) above Earth. Such a cable would have considerable mass. So to stop it from falling, it would have to be balanced at the other end by a similar orbiting mass. The entire elevator would then be supported by centrifugal forces.

For many years, physicists, science fiction writers and visionaries have excitedly calculated the size of these forces, only to be sadly disheartened by the result. No known material is strong enough to cope with these forces—not spider silk, not Kevlar, not even the strongest modern carbon fiber polymers.

So Penoyre and Sandford have taken a different approach. Instead of anchoring the cable on Earth, they propose anchoring it on the moon and dangling it toward Earth.

The big difference comes from the centrifugal forces. A conventional space elevator would make a complete rotation every day, in line with Earth's rotation. But the moon-based spaceline would orbit just once a month—a much slower rate with correspondingly lower forces.

What's more, the forces are arranged differently. In extending from the moon to Earth, the spaceline would pass through a region of space where terrestrial and lunar gravity cancel each other out.

This region, known as a Lagrange point, becomes a central feature of a spaceline. Beneath it, closer to Earth, gravity pulls the cable toward the planet. But above it, closer to the moon, gravity pulls the cable toward the lunar surface.

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Penoyre and Sandford quickly show that extending the cable from the moon all the way to Earth's surface generates forces that are too great for today's materials. But the cable need not stretch all the way to be useful.

The researchers' main result is to show that today's strongest materials—carbon polymers like Zylon—could comfortably support a cable stretching from the moon to geosynchronous orbit. They go on to suggest that a proof-of-principle device made from a cable about the thickness of a pencil lead could be dangled from the moon at a cost measured in billions of dollars.

That's clearly ambitious but by no means excessive for modern space missions. "By extending a line, anchored on the moon, to deep within Earth's gravity well, we can construct a stable, traversable cable allowing free movement from the vicinity of Earth to the Moon's surface," say Penoyre and Sandford.

The savings would be huge. "It would reduce the fuel needed to reach the surface of the moon to a third of the current value," they say.

And it would open up an entirely new region of space to exploration—the Lagrange point. This is of interest because both gravity and the gravity gradient in this region is zero, making it much safer for construction projects. By contrast, the gravity gradient in low Earth orbit causes orbits to be much less stable.

"If you drop a tool from the International Space Station it will seem to rapidly accelerate away from you," point out Penoyre and Sandford. "The Lagrange point has an almost negligible gradient in gravitational force; the dropped tool will stay close at hand for a much longer period."

Neither is there any significant debris in this region. "The Lagrange point has been mostly untouched by previous missions, and orbits passing through here are chaotic, greatly reducing the amount of meteoroids," they say.

For these reasons, Penoyre and Sandford say access to the Lagrange point is major advantage of the spaceline. "The Lagrange point base camp is the thing we believe to be most important and influential for the early use of the spaceline (and for human space exploration in general)," they say. "Such a base camp would allow construction and maintenance of a new generation of space-based experiments—one could imagine telescopes, particle accelerators, gravitational wave detectors, vivariums, power generation and launch points for missions to the rest of the solar system."

That's interesting work that invites a renewed focus on the idea of a space elevator. Cheap access to the Lagrange point, the moon, and points beyond may just have become considerably cheaper and more likely.

The Brighter Side of News, 7 July 2022

https://thebrighterside.news

Why it is so hard for humans to have a baby?

2022-07-05

New research by a scientist at the Milner Center for Evolution at the University of Bath suggests that "selfish chromosomes" explain why most human embryos die very early on. The study, published in PLoS Biology, explaining why fish embryos are fine but sadly humans' embryos often don't survive, has implications for the treatment of infertility.

About half of fertilized eggs die very early on, before a mother even knows she is pregnant. Tragically, many of those that survive to become a recognized pregnancy will be spontaneously aborted after a few weeks. Such miscarriages are both remarkably common and highly distressing.

Professor Laurence Hurst, Director of the Milner Center for Evolution, investigated why, despite hundreds of thousands of years of evolution, it's still so comparatively hard for humans to have a baby.

The immediate cause of much of these early deaths is that the embryos have the wrong number of chromosomes. Fertilized eggs should have 46 chromosomes, 23 from mum in the eggs, 23 from dad in the sperm.

Professor Hurst said: "Very many embryos have the wrong number of chromosomes, often 45 or 47, and nearly all of these die in the womb. Even in cases like Down syndrome with three copies of chromosome 21, about 80% sadly will not make it to term."

Why then should gain or loss of one chromosome be so very common when it is also so lethal?

There are number of clues that Hurst put together. Firstly, when the embryo has the wrong number of chromosomes it is usually due to mistakes that occur when the eggs are made in the mother, not when the sperm is made in the father. In fact, over 70% of eggs made have the wrong number of chromosomes.

Secondly, the mistakes happen in the first of two steps in the manufacture of eggs. This first step, it had been noticed before, is vulnerable to

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mutations that interfere with the process, such that the mutation can "selfishly" sneak into more than 50% of the eggs, forcing the partner chromosome to be destroyed, a process known as centromeric drive. This is well studied in mice, long suspected in humans and previously suggested to somehow relate to the problem of chromosome loss or gain.

What Hurst noticed was that, in mammals, a selfish mutation that tries to do this but fails, resulting in an egg with one too many or one too few chromosomes, can still be evolutionarily better off. In mammals, because the mother continuously feeds the developing fetus in the womb, it is evolutionarily beneficial for embryos developing from faulty eggs to be lost earlier rather than be carried to full term. This means that the surviving offspring do better than the average.

Hurst explained: "This first step of making eggs is odd. One chromosome of a pair will go to the egg the other will be destroyed. But if a chromosome 'knows' it is going to be destroyed it has nothing to lose, so to speak. Remarkable recent molecular evidence has found that when some chromosomes detect that they are about to be destroyed during this first step, they change what they do to prevent being destroyed, potentially causing chromosome loss or gain, and the death of the embryo.

"What is remarkable, is that if the death of the embryo benefits the other offspring of that mother, as the selfish chromosome will often be in the brothers and sisters that get the extra food, the mutation is better off because it kills embryos".

"Fish and amphibians don't have this problem", Hurst commented. "In over 2000 fish embryos not one was found with chromosomal errors from mum". Rates in birds are also very low, about 1/25th the rate in mammals. This, Hurst notes, is as predicted as there is some competition between nestlings after they hatch, but not before.

By contrast, chromosome loss or gain is a problem for every mammal that has been looked at. Hurst commented, "It is a downside of feeding our offspring in the womb. If they die early on, the survivors benefit. It leaves us vulnerable to this sort of mutation."

Hurst suspects that humans may indeed be especially vulnerable. In mice the death of an embryo gives resources to the survivors in the same brood. This is gives about a 10% increase in survival chance of the others. Humans, however, usually just have one baby at a time and the death of

an embryo early on enables a mother to rapidly reproduce again—she probably never even knew her egg had been fertilized.

Preliminary data shows mammals such as cows, with one embryo at a time seem to have especially high embryo death rates owing to chromosomal errors, while those with many embryos in a brood, like mice and pigs, seem to have somewhat lower rates.

Hurst's research also suggests that low levels of a protein called Bub1 could cause loss or gain of a chromosome in humans as well as mice.

Hurst said: "The levels of Bub1 go down as mothers get older and as the rate of embryonic chromosomal problems goes up. Identifying these suppressor proteins and increasing their level in older mothers could restore fertility.

"I would hope too that these insights will be one step to helping those women who experience difficulties getting pregnant, or suffer recurrent miscarriage."

Phys Org, 5 July 2022

https://phys.org

ADHD drugs could help treat symptoms of Alzheimer's

2022-07-06

A new systematic review has found repurposing some drugs currently used for ADHD and depression could offer small improvements to cognitive symptoms associated with Alzheimer's disease. The review focused on a family of drugs developed to stimulate the brain's noradrenaline system.

Noradrenergic drugs have been used for decades to treat a variety of conditions from attention deficit hyperactivity disorder (ADHD) and depression, to insomnia and high blood pressure. They work by targeting a neurotransmitter called norepinephrine, which plays a role in a number of cognitive processes including arousal, attention and memory.

Over the years, as far back as the 1980s, a number of small clinical trials investigated the effects of noradrenergic drugs on Alzheimer's. However, the results were never generally convincing enough to be seriously pursued, and other research areas became more popular targets for study.

More recently, a number of studies have rekindled interest in the relationship between Alzheimer's and the brain's noradrenaline

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system. From discoveries suggesting the earliest stages of Alzheimer's neurodegeneration may occur in the locus coeruleus (LC), a brain region responsible for the production of norepinephrine, to indications apathy is an early symptom of disease, a team of UK researchers were inspired to review past investigations into the effect of noradrenergic drugs on the disease.

The review pooled data from 19 previously published studies, encompassing 1,811 patients. A number of different noradrenergic drugs were studied in the review, including modafinil, mirtazapine, and clonidine.

The results revealed that use of this family of drugs led to small, but significant, improvements in cognition and large improvements in apathy. The researchers are cautious to note the limitations in pooling data from different trials conducted over several decades, but they do conclude there is a good case to be made for a new clinical trial investigating whether these drugs could be useful as a treatment for Alzheimer's.

The research looked at 40 years of clinical trials investigating the effects of nor-adrenergic drugs on Alzheimer's disease symptoms

"In patients with dementia or MCI [mild cognitive impairment] caused by Alzheimer's disease, pharmacotherapies targeting the noradrenergic system can improve cognition and apathy," the review concluded. "These therapies do not appear to have any beneficial effects on attention or episodic memory. Based on this meta-analysis, and recognition of the importance of LC-NA system in multiple neurodegenerative diseases, there is a case for further clinical trials of noradrenergic agents in Alzheimer's disease and other neurodegenerative conditions."

Experts not affiliated with this new review call the findings promising. David Smith, from the University of Oxford, said the analysis was important and well-performed, but stressed these drugs may only slightly improve a patient's symptoms and don't seem to influence progression of disease.

"There was no evidence that the drugs influenced the progression of the disease but they did improve a few symptoms, notably apathy," Smith said. "A small, probably not clinically relevant, improvement in cognition was also found. The report should stimulate further trials in particular with combinations of these drugs with other symptomatic treatments."

Sian Gregory, from the Alzheimer's Society, said there is a lack of treatments available to Alzheimer's patients right now and something that could even slightly alleviate a patient's symptoms may be valuable. Gregory called for further clinical trials to explore the potential for noradrenergic drugs for Alzheimer's.

"This promising new research could help to improve the lives of people living with Alzheimer's disease in the future, helping to reduce the effect of common symptoms such as memory and thinking problems and improving apathy," said Gregory. "Because drugs that act on the chemical messenger noradrenaline are already commonly used to treat disorders like ADHD and depression, clinical trials to assess their benefit for people with Alzheimer's disease should be straightforward."

The new study was published in the Journal of Neurology Neurosurgery & Psychiatry.

New Atlas, 6 July 2022

https://newatlas.com

Revealed: US water likely contains more 'forever chemicals' than EPA tests show

2022-07-06

A Guardian analysis of water samples from around the United States shows that the type of water testing relied on by the US Environmental Protection Agency (EPA) is so limited in scope that it is probably missing significant levels of PFAS pollutants.

The undercount leaves regulators with an incomplete picture of the extent of PFAS contamination and reveals how millions of people may be facing an unknown health risk in their drinking water.

The analysis checked water samples from PFAS hot spots around the country with two types of tests: an EPA-developed method that detects 30 types of the approximately 9,000 PFAS compounds, and another that checks for a marker of all PFAS.

The Guardian found that seven of the nine samples collected showed higher levels of PFAS in water using the test that identifies markers for PFAS, than levels found when the water was tested using the EPA method – and at concentrations as much as 24 times greater.

"The EPA is doing the bare minimum it can and that's putting people's health at risk," said Kyla Bennett, policy director at the advocacy group Public Employees for Environmental Responsibility

Ties to cancer

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Guardian analysis of water samples taken in nine US locations shows test agency uses is likely missing significant levels of PFAS pollutants

PFAS are a class of chemicals used since the 1950s to make thousands of products repel water, stains and heat. They are often called "forever chemicals" because they don't fully break down, accumulating in the environment, humans and animals. Some are toxic at very low levels and have been linked to cancer, birth defects, kidney disease, liver problems, decreased immunity and other serious health issues.

The Biden administration in June announced new actions aimed at protecting drinking water from PFAS contamination, saying the chemicals "pose a serious threat across rural, suburban and urban areas". The administration has allocated $10bn to specifically address PFAS and other contaminants in drinking water.

But critics say when it comes to identifying PFAS-contaminated water, the limitations of the test used by state and federal regulators, which is called the EPA 537 method, virtually guarantees regulators will never have a full picture of contamination levels as industry churns out new compounds much faster than researchers can develop the science to measure them.

That creates even more incentive for industry to shift away from older compounds: if chemical companies produce newer PFAS, regulators won't be able to find the pollution.

"Industry has had a 70-year head start and we're never going to catch up," said Graham Peaslee, a University of Notre Dame researcher.

Many researchers consider a type of test known as "total organic fluorine" (TOF), which detects a PFAS marker called organic fluorine, to be the most accurate way to test water samples.

The European Union is proposing switching to a TOF test, and states such as Maine, which are planning to regulate PFAS as a class instead of regulating individual compounds, will need more robust testing to enforce their laws.

"The TOF isn't the end-all, but it's telling us there's more fluorine out there, and we need to look for it," Peaslee said.

Clean water advocacy groups last year urged the EPA to use more comprehensive tests that they said would "give us a better understanding of the totality of PFAS contamination", but the agency told the Guardian it currently has no such plans.

In a statement to the Guardian, the EPA said it "continues to conduct research and monitor advances in analytical methodologies … that may improve our ability to measure more PFAS".

For researchers worried about PFAS contamination, that is not good enough.

"We're looking for and studying less than 1% of PFAS so what the heck is that other 99%?" Peaslee asked. "I've never seen a good PFAS, so they're all going to have some toxicity."

Guardian sampling

The samples analyzed for the Guardian were collected from municipal systems and private wells, including both filtered and unfiltered water. An accredited lab conducted the EPA 537 test, while Peaslee checked the samples using a TOF method he developed.

In unfiltered water from Portsmouth, New Hampshire, the levels were 10 parts per trillion (ppt) in the EPA 537 test and 164ppt in the TOF test.

Water samples collected in Titusville, Florida, also showed a large disparity – the EPA 537 test found PFAS at 16ppt, while the TOF test found PFAS levels at 176ppt. In Bethesda, Maryland, the results were 18ppt from the government-favored test and 185ppt from the TOF.

Similar results were seen in sampling from other communities, including in Wisconsin, North Carolina, Arizona and Massachusetts.

Though the EPA doesn't have limits in place for mixes of PFAS compounds, many public health advocates say no level over 1ppt is safe.

One of the samples in the Guardian analysis – water from Oscoda, Michigan – showed 13.7ppt in the EPA 537 test and 0 (non-detect) for the TOF test. Testing of a sample from Gustavus, Alaska, found 127ppt in the EPA 537 test, and a lower amount – 102 ppt – in the TOF test, considered within the margin of error.

The EPA and industry have long argued that many newer PFAS that can't be detected are safe. However, most new compounds have not been independently reviewed, and the types of PFAS that have been studied have been found to be toxic and persistent in the environment, said Bennett.

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"There are so many PFAS that we don't know anything about, and if we don't know anything about them, how do we know they aren't hurting us?" Bennett asked. "Why are we messing around?"

The test results for Portsmouth, where water tested by the TOF method revealed levels around 16 times higher than the EPA 537 method found, is probably due to some combination of issues, Peaslee said.

Though firefighting foam used at Pease air force base in Portsmouth and elsewhere is largely made with PFAS compounds the EPA test can detect, the chemicals, once in the environment, break down into different PFAS compounds that can't be detected.

It's also possible that other sources are polluting the region's water with newer PFAS that can't be read by the EPA test.

The results are "surprising", said Andrea Amico, a public health advocate who in 2014 first sounded the alarm about Portsmouth's PFAS contamination, and who collected the water sample from Portsmouth used in the Guardian analysis.

"That's left me with more questions about what's making up that total and makes me want more testing in my community," she added.

Health problems

In the region around Cape Canaveral, Florida, which includes Titusville, some suspect PFAS contamination stemming from two military bases and Nasa facilities is behind their health problems.

Since 2019, Titusville utility officials have either reported no PFAS in the city's drinking water or have said detections were at levels considered by regulators to be safe. But the TOF analysis for the Guardian detected 176ppt in the water there.

Among the water samples collected for the Guardian, some came from the home of a Titusville resident who suffers thyroid problems, a condition linked to PFAS exposure. The resident, who declined to be named, can't afford a water filtration system, a situation that underscores the fact that many low-income people can be at more risk than people with higher incomes.

"They used [the EPA 537] results as cover," said Stel Bailey, who has suffered from PFAS-linked ailments such as Hodgkin's lymphoma and works with the clean water advocacy group Fight for Zero. "We need better testing technology so we know where to focus."

Contamination stemming from airport and military facilities has also plagued Tucson, Arizona, for years, and new measures put in place by state and local officials are supposed to have largely eradicated the problem.

But water from the home of one south side Tucson resident sampled for the Guardian showed 2ppt in the EPA 537 test and a level 24 times higher in the TOF test. Mary Ann Granillo, the resident of the home where the sampled water came from, has lupus, a PFAS-linked disease that already killed two of her family members.

City officials disputed the veracity of the sampling, stating that south side Tucson residents have not been served water from contaminated areas near airport and military facilities since 1994.

Granillo said she can't afford a water filtration system, and bottled water is an expensive addition to her monthly bills. The family washes dishes, cleans clothes and showers in contaminated water. She fears nothing is likely to change.

"It really worries me a lot," she said.

The Guardian, 6 July 2022

https://theguardian.com

Humans are aggressive, sometimes too much – could 'moral enhancement' technologies offer a solution?

2022-07-08

It's a mistake to think problematic aggression is limited to those with psychiatric disorders. Healthy people have also the capacity for impulsive violence – and resulting "morally" poor behaviour.

Traditionally, moral development has been facilitated by social institutions such as religion, education and societal convention. But technology could change this.

If scientists could identify the predictors of reactive aggression, bio-medicine may offer ways to improve the moral behaviour of those more at risk of problematic aggression.

This concept of "moral enhancement" is strongly contested. Bioethicists ask: can, and should, biomedical interventions be used to make people "morally" better?

If scientists could identify the predictors of reactive aggression, bio-medicine may offer ways to improve the moral behaviour of those more at risk of problematic aggression.

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We need a lot more research before we can weigh up the practical and ethical feasibility of aggression-reducing techniques. But exploration in this space is well under way.

What is 'moral enhancement'?

Broadly, moral enhancement refers to the use of bio-medicine to improve moral functioning. Some suggested methods include decreasing bias, increasing empathy, improving self-control and enhancing intelligence.

While this may seem like science fiction, consider the other types of human enhancement that already exist.

Transhumanists are acquiring new modes of perception through seismic sensors, neural implants and magnetoreception devices. Smart drugs are used for purported cognitive benefits such as memory and alertness – and brain-computer interfaces are fusing mind and machine.

It's not a huge leap, then, to imagine we could target the biological processes that mediate our social behaviours.

Of course, moral enhancement is controversial, and bioethicists disagree over its feasibility and ethical implications. Could it work? And under what conditions (if any) might it be justified?

My latest research explores a proposal I think is underappreciated: that moral outcomes could be improved by reducing aggression.

Everyday aggression

Aggressive disorders have long been treated by medical practitioners. But this is usually confined to psychiatric cases, and we know aggression is more widespread than clinical and forensic statistics reflect.

Research indicates only half of non-fatal violence is reported, with around 72% of unreported cases being assaults that don't cause severe injury. But just because aggression may fall outside a clinical scope, that doesn't mean it's not morally problematic.

Everyday aggression plays out in familiar settings. Violence flares up in professional sports. Parental outbursts at youth matches aren't uncommon; we've seen several examples of mums and dads physically assaulting referees and umpires.

In 2014, one-punch attacks became so frequent in Australia, media outlets deemed them an "epidemic". Then there's road rage, which accounts for numerous cases of injury and property damage each year.

These examples tell us aggression pervades almost every forum of human activity. They suggest otherwise healthy people have the capacity to lose themselves to episodic violence. And perhaps some of us pose a greater hazard than others – without necessarily knowing it.

If we can identify risk-predictors of impulsive aggression, we may be able to prevent some of this spontaneous harm before it's inflicted.

How do we classify aggression?

Psychology defines aggression as any behaviour intended to cause harm. This excludes consensual harm which a person desires for some greater good, such as surgery or tattooing.

Aggression comes in two broad varieties: reactive and instrumental. Reactive aggression is described as "hot-blooded" and involves extreme anger in the face of a threat. Instrumental aggression is "cold-blooded" and involves calculated acts with low emotional arousal.

While both types of aggression can overlap, each has a distinct neurophysiological signature. Reactive aggression activates "primal" parts of the brain, while instrumental aggression recruits more evolved areas in the neocortex.

Morally speaking, there's reason to think reactive aggression is more hazardous than other forms. That doesn't mean instrumental aggression isn't worrisome. In fact, it's involved in some of the most damaging conditions such as criminal psychopathy.

But reactive aggression is different because it lacks higher-order cognition. It engages the relatively basic limbic system – the region of the brain which deals with behavioural and emotional reactions. It also shuts down the prefrontal cortex, which is responsible for rational decision-making.

What can be done?

Precise biomarkers of reactive aggression haven't yet been established, but scientists have identified some key contributors. These include a range of genes, receptors, neurochemicals related to serotonin and dopamine, hyperactivity of the amygdala, and reduced brain matter in particular regions.

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Certain biomedical procedures show promise. Neuromodulation techniques have been found to lower aggression by directly altering brain activity. One example involves a painless procedure in which electrodes are placed on a person's head to excite or inhibit a specific part of the brain.

Researchers have suggested we could use such technology on young people with conduct disorders to prevent problematic behaviour in adulthood.

Another emerging technique is psychedelic-assisted therapy. Working with therapists, patients use substances such as LSD, MDMA, and psilocybin to access altered states of consciousness and positively shape values, thoughts and behaviour. Early clinical trials have shown impressive results for treating conditions including addiction, depression, and post-traumatic stress disorder.

Gene-based strategies such as CRISPR also offer hope for therapeutic and enhancement purposes. These work by inserting genetic material into a person's body to modify or replace unwanted genes. Most gene therapies are still in early trial stages. They'll need much more evaluation before they can used safely and ethically on humans.

Importantly, there are questions over whether moral enhancement is already happening, such as when we take drugs that change our brain chemistry. If so, should we simply think of new moral enhancement strategies as a part of existing pre-emptive medical treatments?

A jar of 'happy pills' sits against a light blue background, with a silver cap unscrewed

The barriers

There are major challenges in implementing any of the above techniques to target aggression. One is non-specificity: the neural structures involved in aggression are also implicated in states such as fear, reward, motivation and threat-detection.

Also, antisocial behaviours can't simply be associated with one or two genes. They're a result of a complex genetic architecture in which hundreds of genes, or even thousands, interact with a person's environment and lifestyle.

Even if we could safely target the determinants of reactive aggression, there are lingering practical and ethical considerations. For one, not

all aggression is antisocial. Aggression is often necessary for acts of protection and self-defence.

People can also have mixed motivations, meaning different aggression types can be present in a single act. To complicate things further, some researchers argue for additional classifications such as "micro-", "prosocial" and "appetitive" aggression.

Any moral enhancement proposals must consider the impact on the person, their character and sense of self. Additionally, there are concerns around autonomy, personal freedom and the possibility of coercive treatment.

These factors would need to be carefully weighed against the potential benefits of moderating an individual's aggressive tendencies.

Moving forward, we need to learn more about the moral significance of different types of aggression, how they present in an individual's actions, and how they're reflected in their biology.

The Conversation, 8 July 2022

https://theconversation.com

'You are what you eat,' and now researchers know exactly what you're eating

2022-07-07

An international team of scientists, led by researchers at University of California San Diego, report a new method called untargeted metabolomics to identify the vast number of molecules derived from food that were previously unidentified, but that appear in our blood and our stool.

The method, described in the July 7, 2022 issue of Nature Biotechnology, matched all of the products of metabolism in a specimen to large databases of samples where chemical inventories were available, providing an unprecedented catalog of the molecule signatures created by consuming food or by processing it in our gut.

The authors said that, used broadly, the new approach could dramatically expand understanding of the sources of chemicals in many kinds of human, animal and environmental samples.

"Good luck getting a cheetah or a gorilla, to name just two species out of the hundreds we're studying, to fill out a food diary."

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"Untargeted mass spectrometry is a very sensitive technique that allows for the detection of hundreds to thousands of molecules that can now be used to create a diet profile of individuals," said co-corresponding author Pieter Dorrestein, Ph.D., director of the Collaborative Mass Spectrometry Innovation Center at Skaggs School of Pharmacy and Pharmaceutical Sciences at the University of California San Diego.

"The expanded ability to understand how what we eat translates into products and byproducts of metabolism has direct implications for human health. We can now use this approach to obtain diet information empirically and understand relationships to clinical outcomes. It is now possible to link molecules in diet to health outcomes not one at a time but all at once, which has not been possible before."

Metabolomics involves the comprehensive measurement of all metabolites in a biological specimen. Metabolites are the substances, usually small molecules, made or used when an organism breaks down food, drugs, chemicals or its own tissues. They are the products of metabolism. The study also used a related technique, metagenomics, to measure genetic material in biological samples and characterize microbes present.

Current metabolomics studies annotate or identify only 10 percent of molecular features in sampled specimens, leaving 90 percent of the material unknown. The new approach uses reference-data-driven (RDD) analysis to match metabolomics data derived from tandem mass spectrometry or MS/MS (an analytical tool that measures molecular weight using two analyzers instead of one) against metadata-annotated data is a pseudo-MS/MS reference library.

Essentially, each molecule is stripped of electrons to make it charged. The charged ion is weighed using a very sensitive scale, then smashed into pieces and those pieces weighed, creating a unique fingerprint for each molecule.

These collections of pieces or "fragmentation spectra" can be matched between the sample being analyzed and a reference database. However, until now the process has been very challenging.

In the new work, researchers investigated thousands of foods contributed by people around the world in the Global FoodOmics initiative launched at UC San Diego seven years ago, building on the success of the citizen-science American Gut Project/The Microsetta Initiative. The scientists increased their data output more than five-old over conventional

techniques. Most importantly, the new method allowed untargeted metabolomics to be used to determine the diet based on a stool or blood sample.

The authors said RDD analysis allowed them to parse dietary patterns (vegan versus omnivore, for example) and consumption of specific foods and more generally, match the data against any existing reference databases.

"This advance is crucial because traditional methods for measuring diet, such as food diaries or food frequency questionnaires, are a pain to fill out and very hard to do accurately," said co-corresponding author Rob Knight, Ph.D., director of the Center for Microbiome Innovation at UC San Diego.

"The potential to read out diet from a sample directly has huge implications for research in populations like people with Alzheimer's Disease, who may not be able to remember or explain what they ate. And in wildlife conservation applications. Good luck getting a cheetah or a gorilla, to name just two species out of the hundreds we're studying, to fill out a food diary."

Of particular interest, said Dorrestein and Knight, were the large improvements in how many of the molecules in blood or stool that could be explained when food items were matched to population, such as matching food from Italy to people from the Cilento peninsula where UC San Diego scientists are collaborating on a study of centenarians.

"This really shows how important it will be to get both food specimens and clinical samples from people around the world in order to understand how our molecules and microbes work together to improve or degrade our health based on the diets we eat," said Knight.

"This study also points the way toward using RDD to explain the dark matter in our metabolome," added Dorrestein, "not only in terms of diet, but in exposures to chemicals from the clothes we wear, the medications we take, the beauty products we apply and the environments we are exposed to. It will truly let us explore the chemical connections between ourselves and the world we inhabit."

Phys Org, 7 July 2022

https://phys.org

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Sight of mouthwatering meals triggers inflammation linked to diabetes

2022-07-03

The sight of a mouthwatering dish can certainly be enough to send our senses into overdrive, and a new study has demonstrated how the mechanisms behind this may play an important role in type 2 diabetes. Scientists have shown for the first time how the sight or smell of a meal can trigger an inflammatory response that guides insulin production, and is also known to play a role in the onset of diabetes, creating some unique possibilities for intervention.

Whether it's patiently waiting for a pizza delivery or the arrival of a steak at a nice restaurant, the anticipation of food can cause a range of responses in the human body. While salivating is one most will be acquainted with, the body also begins producing insulin as a part of this process, a hormone that plays an important role in regulating blood sugar.

This phenomenon is known as the neurally mediated, or cephalic, phase of insulin secretion, but little is known about how exactly the anticipation of food prompts the pancreas to accelerate production of insulin. Researchers from the University of Basel explored this in mice, which were subjected to bouts of fasting and then introduced to food thereafter.

Sampling the blood of the mice immediately after their first bite enabled the scientists to monitor the increase in insulin secretion, and probe the underlying mechanics. Part of this involved a focus on an inflammatory factor called interleukin 1 beta (IL1B), which is part of the body's natural immune response to pathogens and tissue damage. The scientists uncovered another role it plays, by treating the mice with IL1B inhibitors that tempered neurally mediated insulin secretion as a result.

"Our results indicate that IL1B plays an important role in linking up sensory information such as the sight and smell of a meal with subsequent neurally mediated insulin secretion – and in regulating this connection," said study leader Marc Donath.

In healthy individuals, the autonomic nervous system relays the IL1B signals to the pancreas to facilitate insulin secretion. But in mouse models and human studies of obesity, the scientists found that this type of signaling was impaired. The mouse models tied this to IL-1B and showed the dysfunction to be the result of an excessive inflammatory response that compromises insulin production.

A new study has shown that the anticipation of a meal can drive inflammatory responses before we even have the first bite

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Adding to the significance of the discovery is that IL1B is already known to play a role in type 2 diabetes, where it is produced and secreted in large amounts. In this context, it contributes to the chronic inflammation that damages the insulin-producing cells in the pancreas.

"The fact that this inflammatory factor is responsible for a considerable proportion of normal insulin secretion in healthy individuals is surprising, because it's also involved in the development of type 2 diabetes," explains study leader Professor Marc Donath.

This raises the possibility that IL1B inhibitors could be deployed as treatments for diabetes, something the scientists are now looking to explore through clinical studies.

The research was published in the journal Cell Metabolism.

New Atlas, 3 July 2022

https://newatlas.com

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