

Bulletin Board

Contents

MAR. 19, 2021

(click on page numbers for links)

REGULATORY UPDATE

ASIA PACIFIC

Requirements for information lists when submitting an application for agricultural and veterinary products.....	4
Use of the trademark symbol.....	4
Polystyrene to be phased out next year under Australia's plastic waste plan.....	5

AMERICA

Canada: Consolidation of OHS regulations: The Occupational Health and Safety Regulations, 2020	6
NIEHS-funded study finds graphene nanochannel filters hold promise for contaminant clean-up.....	7
Democrats push FDA to regulate toxic metals in baby food after investigation finds high levels.....	8
Biden EPA to reconsider Trump rule on lead in drinking water.....	9

EUROPE

France recommends OELs for Titanium Dioxide Nanoparticles.....	10
Recommendations on implementation of EPR.....	11

REACH UPDATE

'Major weakening': NGOs warn over industry proposals for chemicals regulation.....	13
Eight proposals to identify new substances of Very High Concern	15

JANET'S CORNER

Iron-y.....	17
-------------	----

HAZARD ALERT

Hydroquinone	18
--------------------	----

GOSSIP

This 'Ninja Giant' is the oldest titanosaur on record.....	21
--	----

CONTACT US

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

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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

Bulletin Board

Contents

MAR. 19, 2021

Eight ways chemical pollutants harm the body.....	22
Pollen can raise your risk of COVID-19 – and the season is getting longer thanks to climate change.....	24
The world wasted nearly 1 billion metric tons of food in 2019.....	26
Oil in the ocean photooxidizes within hours to days, new study finds	27
Ancient hippo-size reptile was a quick and ferocious killing machine.....	28
More twins are being born than ever before	31
6 months of summer could be the norm by 2100, study finds	33
Tool to modify sugars on “undruggable” proteins may uncover new treatments	34
Stable 2D boron material created for the first time	36

CURIOSITIES

Saudi Arabia's wants to build a 105-mile-long 'Line' city in the desert	38
How is this horse feeling? New mobile brain wave reader could tell.....	40
The device that reverses CO2 emissions.....	42
String of code sells for \$69 million.....	48
An experimental toothpaste aims to treat peanut allergy	49
Scientists find a natural protein that stops allergies and autoimmune conditions	51
Your brain warps your memories so you can remember them better.....	53
Something is killing California's songbirds	55
Scientists create self-replicating chemicals to help explain the origins of life.....	57
What fueled humans' big brains? Controversial paper proposes new hypothesis.....	60

TECHNICAL NOTES

(Note: Open your Web Browser and click on Heading to link to section) ..	64
CHEMICAL EFFECTS	64
ENVIRONMENTAL RESEARCH	64
OCCUPATIONAL.....	64
PHARMACEUTICAL/TOXICOLOGY	64

Bulletin Board

Contents

MAR. 19, 2021

Bulletin Board

Regulatory Update

MAR. 19, 2021

ASIA PACIFIC

Requirements for information lists when submitting an application for agricultural and veterinary products

Y2021-03-11

The Agvet Code and Agvet Code Regulations require the Australian Pesticides and Veterinary Medicines Authority (APVMA) to record and publish a short description of each item of information contained in, or accompanying, applications for approval, registration or variation of relevant particulars, or conditions of approvals and registration (known as an information list).

This includes, but is not limited to, the following items:

- The title shown on the item of information.
- The name and address of the authorising party for the information.
- The name of the author, or each of the authors, of the information.

Registrants for agricultural and veterinary products must abide by the legislative requirements when submitting information lists to the APVMA. Information lists that do not comply with the Agvet Code and Agvet Code Regulations will be returned to the registrant for amendment, which may result in delays during the evaluation period.

Our guidance for preparing information lists provides additional detail about the specific types of information that may be consolidated into a single document or entry in an information list.

Questions about the legislative requirements for information lists may be directed to enquiries@apvma.gov.au

[Read More](#)

APVMA, 11 March 2021

<https://apvma.gov.au/node/83431>

Use of the trademark symbol

2021-03-11

The registered trademark symbol, ®, is reserved for trademarks registered with an appropriate government agency. The trademark symbol itself is not part of a product name and is therefore not considered to be a

Bulletin Board

Regulatory Update

MAR. 19, 2021

relevant particular in relation to the registration of a chemical product and label approval.

The APVMA will not include the trademark symbol in conjunction with a product name in any approval documentation we issue. A trademark can be included on the marketed label of a registered product without the need to notify the APVMA.

APVMA, 11 March 2021

<https://apvma.gov.au/node/83431>

Polystyrene to be phased out next year under Australia's plastic waste plan

2021-03-04

Conservation groups welcome aspects of the largely voluntary packaging and recycling targets but warn regulation will be necessary

Polystyrene foam commonly used to package consumer goods will be phased out in Australia by mid-2022 as part of a national plan to combat mounting plastic waste.

Conservation groups have welcomed many aspects of the plan, which also includes an end to polystyrene food and beverage containers by the end of 2022, but also criticised its largely voluntary approach to reaching ambitious goals, calling for those targets to be mandated.

The Morrison government also announced it would support "coordinated global action to address marine plastic" through the United Nations, which is developing a treaty on the issue.

The National Plastics Plan, launched in Brisbane by the federal environment minister, Sussan Ley, and the assistant minister for waste reduction and environmental management, Trevor Evans, also included targets to cut plastic pollution from washing machine outflows and from cigarette butts.

By July 2022, Australia should have phased out plastic packaging products that do not meet compostable standards, as well as polystyrene used in loose and moulded forms for a wide range of consumer goods.

The Agvet Code and Agvet Code Regulations require the Australian Pesticides and Veterinary Medicines Authority (APVMA) to record and publish a short description of each item of information contained in, or accompanying, applications for approval, registration or variation of relevant particulars, or conditions of approvals and registration (known as an information list).

Polystyrene foam commonly used to package consumer goods will be phased out in Australia by mid-2022 as part of a national plan to combat mounting plastic waste.

Bulletin Board

Regulatory Update

MAR. 19, 2021

Read More

The Guardian, 4 March 2021

<https://www.theguardian.com/australia-news/2021/mar/04/polystyrene-to-be-phased-out-next-year-under-australias-plastic-waste-plan>

AMERICA

Canada: Consolidation of OHS regulations: The Occupational Health and Safety Regulations, 2020

2021-03-01

Three sets of related regulations in Saskatchewan will soon be one.

Prior to April 1, 2021, the province's occupational health and safety ("OHS") regulations under *The Saskatchewan Employment Act* include all of the following:

- 1) The Occupational Health and Safety Regulations, 1996, RRS c O-1.1 Reg 1 (the "1996 OHS Regs");
- 2) The Occupational Health and Safety (Workplace Hazardous Materials Information System) Regulations, RRS c S-15 Reg 6 (the "WHMIS OHS Regs"); and
- 3) The Occupational Health and Safety (Prime Contractor) Regulations, RRS c S-15.1 Reg 2 (the "Prime Contractor OHS Regs").

Fortunately, as of April 1 of this year, there will be a one-stop shop for all things related to OHS regulations: *The Occupational Health and Safety Regulations, 2020*, RRS S-15.1 Reg 10 (the "2020 OHS Regs").

This new set of regulations combines all three of the former regulations into one set—the 1996 OHS Regs make up the overall framework of the new regulations, while the WHMIS OHS Regs and the Prime Contractor OHS Regs have been added as Part 22 and Part 33 of the new regulations, respectively.

Some of the additional substantive changes implemented in the 2020 OHS Regs are as follows:

- 1) adoption of the Canadian Standards Association ("CSA") standard Z2110-17, which provides minimum first aid requirements to be met, including:

Bulletin Board

Regulatory Update

MAR. 19, 2021

- a) undertaking a workplace first aid risk assessment conducted by a competent person;
 - b) maintaining first aid kits with supplies and equipment corresponding with the risk level identified by the risk assessment; and
 - c) providing first aid personnel on the worksite/workplace corresponding with the risk level identified by the risk assessment and the number of workers (s. 5-3 of the 2020 OHS Regs);
- 2) repealing Tables 9 through 12 of the 1996 OHS Regs, since these requirements are already established in the CSA standard (Appendix to the 2020 OHS Regs); and
 - 3) removal of the exemption from the blasting requirements for workers doing seismic exploration (s. 26-1 of the 2020 OHS Regs).

Mondaq, 1 March 2021

<https://www.mondaq.com/canada/employee-rights-labour-relations/1040866/consolidation-of-ohs-regulations-the-occupational-health-and-safety-regulations-2020>

NIEHS-funded study finds graphene nanochannel filters hold promise for contaminant clean-up

2021-03-03

The March 2021 issue of *Environmental Factor*, a monthly newsletter published by the National Institute of Environmental Health Sciences (NIEHS), includes an item entitled "[New graphene nanochannel filters hold promise for contaminant clean-up.](#)" According to the item, an NIEHS-funded study found a new strategy to design nanomaterials to filter contaminants better from water. To improve the usefulness of graphene oxide nanosheets for filtering contaminants from liquid, the researchers modified how the sheets are assembled, "reduc[ing] the distance water must pass through while optimizing the amount of contact it has with the membrane." The item states: "In proof-of-concept tests, the team demonstrated that water vapor could easily pass through the vertically aligned zirconium-graphene membranes, while the organic molecules hexane and 2-propanol could not." The researchers "also showed that their strategy successfully retained molecular selectivity while remaining stable at high temperatures and resistant to swelling, all important factors for scaling up the approach."

According to the item, an NIEHS-funded study found a new strategy to design nanomaterials to filter contaminants better from water.

Three sets of related regulations in Saskatchewan will soon be one.

Bulletin Board

Regulatory Update

MAR. 19, 2021

[Read More](#)

Nano and Other Emerging Chemical Technologies Blog, 3 March 2021

<https://nanotech.lawbc.com/2021/03/niehs-funded-study-finds-graphene-nanochannel-filters-hold-promise-for-contaminant-clean-up>

Democrats push FDA to regulate toxic metals in baby food after investigation finds high levels

2021-03-04

Top Democrats are pushing the FDA to regulate toxic metals in baby food after a congressional investigation discovered the presence of metals like arsenic, lead and cadmium at levels far higher than those allowed in bottled water and other products.

Sens. Amy Klobuchar, D-Minn., and Tammy Duckworth, D-Ill., as well as Reps. Raja Krishnamoorthi, D-Ill., and Tony Cardenas, D-Calif., told CNBC that they are urging the regulatory agency to place limits on toxic heavy metal content in baby food.

The Food and Drug Administration does not currently set limits on heavy metals for baby foods, specifically, except for arsenic in rice cereal. The agency does regulate other toxins in consumer products such as lead, arsenic and cadmium in bottled water.

The four Democrats said Thursday they have drafted legislation that would strengthen regulations for baby food safety and have sent it to FDA staff for technical review. But the lawmakers want the FDA to use their existing regulatory authority to take immediate action.

“Through our legislation and FDA regulatory action, we will ensure that the baby foods that reach the market are safe and that our children are safe,” Krishnamoorthi said in a statement. “I’m proud to partner with my colleagues along with the FDA, stakeholders, and health experts across the country in developing comprehensive reforms.”

[Read More](#)

CNBC, 4 March 2021

<https://www.cnn.com/2021/03/04/democrats-push-fda-to-regulate-toxic-metals-in-baby-food.html>

Bulletin Board

Regulatory Update

MAR. 19, 2021

Biden EPA to reconsider Trump rule on lead in drinking water

2021-03-11

The Biden administration said Wednesday it was delaying the effective date of a policy intended to prevent lead pollution of drinking water, continuing a decades-old debate over how to remove a serious health hazard to children.

The Environmental Protection Agency said it was suspending a regulatory rewrite completed by the Trump administration in December, which is being challenged in court by numerous states and advocacy groups.

The agency hasn’t decided whether to seek changes but wants to review the revised rule, take public input and consult with affected parties, a spokeswoman said.

Critics contend the new measure is weak and gives public utilities too long to replace aging, lead-tainted pipes such as those that contaminated drinking water in Flint, Michigan.

“It is essential that EPA takes the time now to review this important rule to ensure that we are protecting current and future generations,” said Radhika Fox, acting assistant administrator for water.

The overhaul had been scheduled to take effect March 16. Instead, the date was pushed to June 17 to allow comments on an additional proposed delay until Dec. 16.

Also, the agency wants to bump the compliance deadline to Sept. 16, 2024, giving drinking water systems three years to meet the new requirements.

The regulatory update was completed six years after Flint became a national symbol of the longstanding threat from lead, which can disrupt children’s brain development, causing learning and behavior problems. Adults also can suffer nervous system and kidney damage.

Residents of the majority-black city and advocacy groups say systemic racism affected decisions that caused the contamination and the slow government response.

The Trump administration’s overhaul requires utilities to test water at schools and day care centers and to disclose the location of lead-

“It is essential that EPA takes the time now to review this important rule to ensure that we are protecting current and future generations,” said Radhika Fox, acting assistant administrator for water.

Bulletin Board

Regulatory Update

MAR. 19, 2021

containing service lines, which run from main water pipes to homes. It also toughens testing procedures.

But environmental groups said it would give water systems up to 33 years to replace an estimated 6 million remaining lead service lines, instead of 14 years under the previous rule.

[Read More](#)

AP News, 11 March 2021

<https://apnews.com/article/michigan-utilities-environment-flint-traverse-city-8817d4d3c771a2dcffe44860cd16c0e1>

EUROPE

France recommends OELs for Titanium Dioxide Nanoparticles

2021-03-11

On March 4, 2021, the French Agency for Food, Environmental and Occupational Health and Safety (ANSES) announced that it is recommending an eight-hour occupational exposure limit (OEL) of 0.80 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for titanium dioxide nanoparticles. According to ANSES, compliance with this value “should help prevent lung inflammation, an effect that occurs at the lowest exposure concentrations.” Due to the lack of available data on the immediate or short-term effects of titanium dioxide nanoparticles, in accordance with its methodological guide, ANSES states that it also recommends not exceeding the concentration of 4.0 $\mu\text{g}/\text{m}^3$ over a 15-minute period. Compliance with this value should help limit the size and number of exposure peaks over the working day, according to ANSES.

ANSES notes that an expert appraisal on the assessment of methods for measuring titanium dioxide nanoparticles in air is currently under way. ANSES states that this will determine which method(s) to use to measure titanium dioxide nanoparticle concentrations in air in view of the OELs it recommended. In addition, ANSES states, the studies it requested when assessing titanium dioxide under the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation “should enable these values to be further refined.”

According to ANSES, compliance with this value “should help prevent lung inflammation, an effect that occurs at the lowest exposure concentrations.”

Bulletin Board

Regulatory Update

MAR. 19, 2021

[Read More](#)

Nano and Other Emerging Technologies Blog, 11 March 2021

<https://nanotech.lawbc.com/2021/03/france-recommends-oels-for-titanium-dioxide-nanoparticles>

Recommendations on implementation of EPR

2021-03-11

On March 10, 2021, Matt Prindiville of the civil society organization *Upstream* published an overview article on the history, background, and most recent developments in the Extended Producer Responsibility (EPR) packaging debate. In addition, he also gives recommendations to consider when attempting to implement EPR policies successfully.

Prindiville explains that the beginnings of EPR-focused policy work were hampered, especially due to stakeholders misunderstanding the concept, a lack of interest from industry and politicians, as well as China’s open recycling and waste policy. Extensive implementation of the EPR concept would mean, for example, consumer brands such as *Nestlé* would be required to “pay for the collection and recycling of their packaging, plus litter prevention and clean-up and public outreach.” The article reports that much has changed in recent years due to better communication of the concept towards policymakers, as well as political actions to ban plastic waste trade such as the Basel Convention (FPF reported) and the Chinese waste import embargo (FPF reported).

In the article, Prindiville gives recommendations policymakers should consider when attempting to implement EPR schemes. According to Prindiville, EPRs are the foundation of a circular economy, however, many more actions are needed, for example, expanding container deposits and source reduction/reuse policies. Furthermore, he discourages viewing EPR as “a way to determine who finances and optimizes recycling.” He recommends instead that EPR packaging legislation should focus on developing new reuse/refill systems that could greatly reduce upstream impacts, as well as including targets for litter prevention and mitigation. *Upstream* advocates that binding reuse targets similar to the EU’s recycling targets for plastics would “create the conditions in which businesses can safely invest in the associated technology and infrastructure for reuse to scale.” Business sectors such as individual foodservice companies should “use reusable packaging at a rate of 25% within 5 years and 50% within 10 years of adoption.”

In the article, Prindiville gives recommendations policymakers should consider when attempting to implement EPR schemes.

Bulletin Board

Regulatory Update

MAR. 19, 2021

[Read More](#)

Food Packaging Forum, 11 March 2021

<https://www.foodpackagingforum.org/news/recommendations-on-implementation-of-epr>

Bulletin Board

REACH Update

MAR. 19, 2021

'Major weakening': NGOs warn over industry proposals for chemicals regulation

2021-03-09

Industry proposals that the new UK chemicals regulator should rely on "basic and publicly available data" would be a "major weakening" of the government's post-Brexit chemicals regulation regime, a coalition of green groups and cancer charities has warned.

As part of its membership of the EU, the UK was part of EU REACH, a pan-European structure intended to regulate and control the use of chemicals.

However, since its departure from the EU, the UK has been developing plans for its own UK REACH to replace the scheme.

Last month, a letter seen by *The Financial Times*, signed by the heads of 25 businesses and chemical industry associations demanded a radical rethink of the emerging UK REACH regime.

It expressed concern about the shape of the new system, warning that it would "hit UK industry hard across a range of manufacturing sectors", drive up costs and drive business away. According to the *FT*, the letter called for "a more proportionate, effective and efficient" UK REACH.

In response to that letter, a group of more than 20 green campaign groups and national cancer charities has written to the government warning that such a move would risk environmental and human health.

The letter, sent to ministers including the environment secretary and business secretary, states that the letter issued by the chemicals industry "proposes that the UK chemicals regulator should rely on basic and publicly available data from EU REACH for the vast majority of substances notified with UK REACH, and only request full datasets for chemicals of 'most concern to the UK'".

It states: "This new proposal ... would be a major weakening of the current UK REACH regime. It would significantly reduce the ability of the regulator to take action to protect the environment and public and workers' health from hazardous chemicals.

"An approach that requires the regulator to constantly ask for more data would create delays and more bureaucracy, increasing risks to human health and the environment and decreasing public confidence in the system".

However, since its departure from the EU, the UK has been developing plans for its own UK REACH to replace the scheme.

Bulletin Board

REACH Update

MAR. 19, 2021

The letter adds that the aim of chemicals regulation “should be to establish the chemicals which pose serious risks to our health and the environment and to put in place measures to ensure that they are used safely, or not at all. It is a dynamic process that depends on access to detailed safety information”.

The letter also says that the chemical industry’s proposals “would leave the new UK regulator with insufficient data to regulate chemical use safely, including as new concerns emerge. And it would create a system similar to the discredited and ineffective EU ‘Existing Chemicals’ process that preceded REACH”.

The group asks for a meeting with the business secretary “to discuss the issues we raise in this letter and to explore the alternative options for avoiding the costs and burdens on industry that do not undermine the level of public health and environmental protection the UK currently enjoys”.

Thalie Martini, chief executive of Breast Cancer UK, one of the signatories to the letter, said: “It is extremely concerning to see industry calling on the government to deregulate the UK Chemicals Regime by relaxing requirements for providing safety data on chemicals. This is a direct consequence of the government’s decision to rule-out aligning with EU chemical controls.

“While many synthetic chemicals in everyday products have improved the quality of our lives, some, such as endocrine disrupting chemicals (which interfere with our hormone system) have adverse health effects, which increase the risk of serious illnesses, including breast cancer. Reduced requirements for the provision of safety data on chemicals weakens the Health & Safety Executive’s ability to protect public health and risks harmful chemicals entering the UK market.”

A government spokesperson said: “We are committed to maintaining our exceptional track record on regulatory enforcement which safeguards human health and the environment.

“We have received the letter and are engaging closely with stakeholders.”

[Read More](#)

ENDS Report, 9 March 2021

<https://www.endsreport.com/article/1709488/major-weakening-ngos-warn-industry-proposals-chemicals-regulation>

Bulletin Board

REACH Update

MAR. 19, 2021

Eight proposals to identify new substances of Very High Concern

2021-03-10

The substances and examples of their uses are:

- 4,4'-(1-methylpropylidene)bisphenol; (bisphenol B) (EC 201-025-1, CAS 77-40-7). The substance is not registered under REACH;
- medium chain-chlorinated paraffins (MCCP) (EC -, CAS -). The substances are used in polymers/rubbers, adhesives and sealants, coating products, working fluids and textile treatment products and dyes;
- phenol, alkylation products (mainly in para position) with C12-rich branched or linear alkyl chains from oligomerisation, covering any individual isomers and/ or combinations thereof (PDDP) (EC -, CAS -). The substances are used in the manufacture of chemicals, rubber products and plastic products;
- 2-(4-tert-butylbenzyl)propionaldehyde and its individual stereoisomers (EC 201-289-8). The substance is used in the manufacture of fragrance substances for use in cleaning and personal care products;
- 2,2-bis(bromomethyl)propane-1,3-diol (BMP); 2,2-dimethylpropan-1-ol, tribromo derivative/3-bromo-2,2-bis(bromomethyl)-1-propanol (TBNPA); 2,3-dibromo-1-propanol (2,3-DBPA) (EC 221-967-7, 253-057-0, 202-480-9; CAS 3296-90-0, 36483-57-5, 1522-92-5, 96-13-9). The substances are used in the manufacture of plastic products and chemicals;
- 1,4-dioxane (EC 204-661-8, CAS 123-91-1). The substance is used in laboratory chemicals, pH regulators, water treatment products and as a solvent for the manufacture of other chemicals;
- glutaral (EC 203-856-5, CAS 111-30-8). The substance is used as a biocide, in leather tanning and in X-ray film processing. A call for evidence to support a potential restriction proposal will be launched in the coming weeks for this substance and will be announced separately at that time; and
- orthoboric acid, sodium salt (EC 237-560-2, CAS 13840-56-7). The substance is not registered under REACH.

The deadline for comments is 23 April 2021.

The deadline for comments is 23 April 2021.

Bulletin Board

REACH Update

MAR. 19, 2021

[Read More](#)

ECHA, 10 March 2021

https://echa.europa.eu/substances-of-very-high-concern-identification?utm_source=echa-weekly&utm_medium=email&utm_campaign=weekly&utm_content=20210310

Bulletin Board

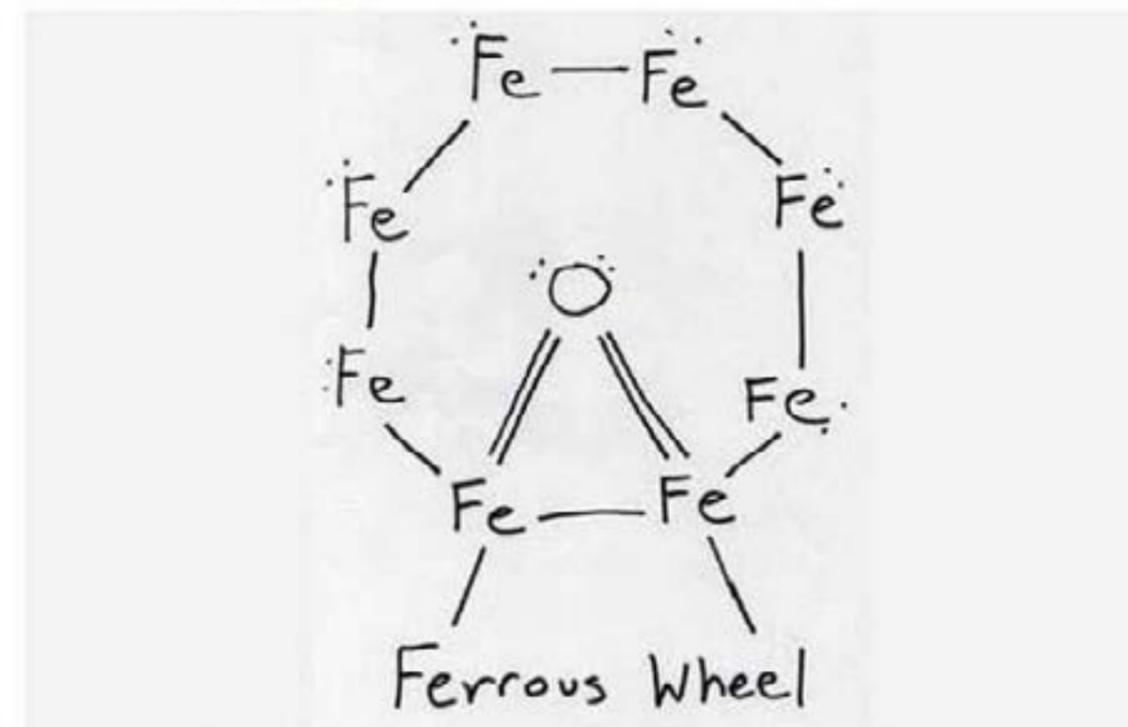
Janet's Corner

MAR. 19, 2021

Iron-y

2021-03-16

Oh, the iron-y.



<https://www.ranker.com/list/funny-science-puns/nathandavidson>

Bulletin Board

Hazard Alert

MAR. 19, 2021

Hydroquinone

2021-03-19

Hydroquinone is a granular white solid organic compound. Its chemical formula is $C_6H_4(OH)_2$, and it is industrially produced by two main methods. It also occurs naturally in multiple places, including in the defense mechanism of a bombardier beetle. It can also be found in the poodle-dog bush, and as an active toxin in the felt-ringed agaricus mushroom. The compound was found to be carcinogenic in rats—when taken orally—however there has been no research into the carcinogenic effects of hydroquinone on humans.

USES [2,3,6]

Hydroquinone has multiple uses across the beauty, photography and oil industries. It is used as a depigmentor in topical skin products to reduce hyperpigmentation, such as liver spots, freckles, “age spots”, and melasma. It works by blocking melanocytes, which produce melanin, which makes you the colour that you are. In photography, it is used in the development of darkroom photographs, as a developer and reducer. It is also found in oils, foods and greases as an antioxidant.

ROUTES OF EXPOSURE [4]

- Hydroquinone is banned in Japan, Australia and across the European Union due to the negative medical effects from the use of hydroquinone-containing products.
- In the U.S., hydroquinone is sold at two different strengths: 2% over-the-counter, and 4% with a prescription and restricted application.

HEALTH EFFECTS

Hydroquinone poisoning affects a range of systems including the integumentary, hormonal and gastrointestinal systems.

Acute Effects [5]

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

- Ingestion of hydroquinone in higher doses can cause tinnitus, dizziness, headaches, vomiting, dyspnea, cyanosis, delirium.
- Ingesting large amounts of the compound can cause edema of the internal organs, convulsions and collapse.

Bulletin Board

Hazard Alert

MAR. 19, 2021

Chronic Effects [5,6,]

Hydroquinone is toxic to multiple body systems. Long-term effects from the exposure to hydroquinone dust can include impaired vision. It has also been found that long-term use of hydroquinone topical creams has led to ochronosis—which can result in the discolouration of the skin to a blueish-black colour. In rodents, it was found that hydroquinone—when applied dermally—increased the incidence of skin tumours.

SAFETY

First Aid Measures [7]

- Inhalation: Move the victim to a fresh air source and monitor their breathing. Call a doctor if symptoms persist.
- Skin contact: If there is skin or hair contact, remove the victim’s clothing, and wash exposed skin with mild soap and water. Continue with a warm water rinse. Clean contaminated clothing before re-wearing. If rash or skin irritation occurs, consult a doctor.
- Eye contact: Rinse eyes with water carefully for a few minutes. Remove contact lenses if present and easy to do so. Continue rinsing. If irritation persists, contact a doctor.
- Ingestion: If swallowed, DO NOT induce vomiting. Rinse mouth with water and contact a medical professional.

Exposure Controls/Personal Protection [7]

- Engineering controls: Safety showers and emergency eyewash fountains should be accessible in the immediate area of the potential exposure. Ensure there is adequate ventilation, and whenever possible, material should be handled in a laboratory.
- Personal protection: Safety glasses and protective gloves should be worn. Do not eat, drink or smoke when using hydroquinone.

REGULATION [2]

United States:

The Occupational Safety and Health Administration has set an 8-hour time weighted average (TWA) concentration for hydroquinone of $2\text{mg}/\text{m}^3$.

Bulletin Board

Hazard Alert

MAR. 19, 2021

Australia [8]

Safe Work Australia: Safe Work Australia has set an 8-hour time TWA for hydroquinone of 2mg/m³.

REFERENCES

1. <https://en.wikipedia.org/wiki/Hydroquinone>
2. <https://www.osha.gov/dts/sltc/methods/partial/pv2094/pv2094.html>
3. <https://www.webmd.com/drugs/2/drug-87530/hydroquinone-skin-bleaching-topical/details>
4. https://www.medicinenet.com/fda_proposes_hydroquinone_ban/views.htm
5. <https://www.epa.gov/sites/production/files/2016-09/documents/hydroquinone.pdf>
6. <https://www.healthline.com/health/beauty-skin-care/hydroquinone>
7. <http://www.labchem.com/tools/msds/msds/LC15500.pdf>
8. <https://www.safeworkaustralia.gov.au/system/files/documents/1912/workplace-exposure-standards-airborne-contaminants.pdf>

Bulletin Board

Gossip

MAR. 19, 2021

This 'Ninja Giant' is the oldest titanosaur on record

2021-03-09

A new long-neck dinosaur discovered in Argentina might be the oldest titanosaur ever discovered.

The dinosaur, dubbed Ninjatitan zapati, lived 140 million years ago, which is 20 million years before the appearance of the next known titanosaur species. The discovery suggests that this group of hefty sauropods first emerged on the supercontinent Gondwana, which was made up of what is now South America, Antarctica, Africa, Australia, New Zealand, the Indian subcontinent and Saudi Arabia.

N. zapati was discovered in 2014 by Jonatan Aroca, a technician of El Chocón Museum in Neuquén, Argentina. Aroca was prospecting at a dig site in southwest Neuquén, located in Patagonia. This site was known for sauropod discoveries, and Aroca was searching for new finds outside of previous excavations when he discovered a titanosaur scapula.

PLAY SOUND

Further excavations turned up some vertebrae, a femur and a fibula (a lower-leg bone). The remains established that the fossils came from a brand-new titanosaur.

Some titanosaurs could grow up to 131 feet (40 meters) in length, but N. zapati was a relative pipsqueak at 66 feet (20 m) long. It still had the column-like legs and long neck and tail of a typical titanosaur, study author Pablo Ariel Gallina, a paleontologist at the National Scientific and Technical Research Council of Argentina, told Live Science.

The researchers named the dinosaur after vertebrate paleontologist Sebastián "Ninja" Apesteguía, who led the first excavations from 2010 to 2014 of the Bajada Colorado Formation where the dinosaur was discovered. Zapati was chosen to honor Rogelio "Mupi" Zapata, a technician of the Museo Municipal Ernesto Bachman, who also made important discoveries at the site.

The discovery puts titanosaurs in the early Cretaceous period in Gondwana, showing that they were already established by this time, Gallina said. Older long-neck dinosaurs have been discovered before, including members of the broader group that titanosaurs are part of, titanosauriforms, which seems to have arisen in the late Jurassic and also includes the brachiosaurids. But N. zapati is the oldest known member of the titanosaur branch of that family tree.

The remains established that the fossils came from a brand-new titanosaur.

Bulletin Board

Gossip

MAR. 19, 2021

The find confirms what paleontologists had suspected about the group based on their worldwide distribution: that they arose early in Gondwana and then spread. One 2016 study suggested that titanosaurs originated in what is now South America, rapidly spread around Gondwana and later reached Europe via North Africa. By the middle to late Cretaceous, titanosaurs reached North America from South America and Asia via Europe. The new discovery bolsters that hypothesis, Gallina said.

“The Bajada Colorada dinosaur fauna represents one of the most diverse and unique associations not previously documented from the lowermost Cretaceous deposits worldwide, a moment in dinosaur evolution little explored,” he wrote in an email to Live Science.

Neuquén province has turned up many intriguing titanosaurs, including one yet-unnamed specimen discovered in January that might be the heaviest titanosaur on record. Paleontologists aren’t done excavating the new specimen, but its competition, Patagotitan mayorum, probably weighed 69 tons (62 metric tons), meaning it was more than 10 times heavier than an African elephant.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 9 March 2021

<https://www.livescience.com>

Eight ways chemical pollutants harm the body

2021-03-07

A new review of existing evidence proposes eight hallmarks of environmental exposures that chart the biological pathways through which pollutants contribute to disease: oxidative stress and inflammation, genomic alterations and mutations, epigenetic alterations, mitochondrial dysfunction, endocrine disruption, altered intercellular communication, altered microbiome communities, and impaired nervous system function.

The study by researchers at Columbia University Mailman School of Public Health, Ludwig Maximilian University, and Hasselt University is published in the journal *Cell*.

“Every day we learn more about how exposure to pollutants in air, water, soil, and food is harmful to human health,” says senior author Andrea Baccarelli, MD, Ph.D., chair of Environmental Health Sciences at Columbia Mailman School. “Less understood, however, are the specific biological pathways through which these chemicals inflict damage on our bodies. In

Bulletin Board

Gossip

MAR. 19, 2021

this paper, we provide a framework to understand why complex mixtures of environmental exposures bring about serious illness even at relatively modest concentrations.”

We are continually exposed to a mixture of pollutants, which lead to changes in our bodies in multiple domains, from conception to old age. They govern gene expression, train and shape our immune systems, trigger physiological responses, and determine wellbeing and disease.

The paper summarizes evidence for eight hallmarks of environmental insults:

1. Oxidative stress and inflammation: When antioxidant defenses are depleted, inflammation, cell death, and organ damage occur.
2. Genomic alterations and mutations: An accumulation of DNA errors can trigger cancer and other chronic diseases.
3. Epigenetic alterations: Epigenetic changes alter the synthesis of proteins responsible for childhood development and regular function of the body.
4. Mitochondrial dysfunction: A breakdown in the cellular powerplant may interfere with human development and contribute to chronic disease.
5. Endocrine disruption: Chemicals found in our environment, food, and consumer products disrupt the regulation of hormones and contribute to disease.
6. Altered intercellular communication: Signaling receptors and other means by which cells communicate with each other, including neurotransmission, are affected.
7. Altered microbiome communities: An imbalance in the population of bacteria and other microorganisms in our body can make us susceptible to allergies and infections.
8. Impaired nervous system function. Microscopic particles in air pollution reach the brain through the olfactory nerve, and can interfere with cognition.

Not all environmental exposures are harmful. The researchers note that exposure to nature has been reported to have beneficial impacts on mental health.

These eight hallmarks are by no means comprehensive and do not capture the full complexity of the chemical and physical properties of

Bulletin Board

Gossip

MAR. 19, 2021

environmental exposures, including mixtures of exposures over the short and long-term. Further research is needed to understand the complex mechanisms by which exposures affect human biology, and how altered processes interact and contribute to disease or confer health benefits, across the life course.

“We need research to expand our knowledge of disease mechanisms going beyond genetics.

Empathy May Be in the Eye of the Beholder

Advances in biomedical technologies and data science will allow us to delineate the complex interplay of environmental insults down to the single-cell level,” says Baccarelli. “This knowledge will help us develop ways to prevent and treat illness. With the serious environmental challenges like air pollution and climate change, most of all, we need strong local, national, and inter-governmental policies to ensure healthy environments.”

neurosciencenews.com, 7 March 2021

<https://www.neuroscience.com>

Pollen can raise your risk of COVID-19 – and the season is getting longer thanks to climate change

2021-03-09

What does pollen have to do with a virus?

The most important takeaway from our new study is that pollen can be a factor in exacerbating COVID-19.

A couple years ago, my coauthors showed that pollen can suppress how the human immune system responds to viruses. By interfering with proteins that signal antiviral responses in cells lining the airways, it can leave people more susceptible to potentially a whole host of respiratory viruses, such as the flu virus and other SARS viruses.

In this study, we looked specifically at COVID-19. We wanted to see how the number of new infections changed with the rise and fall of pollen levels in 31 countries around the world. We found that, on average, about 44% of the variability in COVID-19 case rates was related to pollen exposure, often in synergy with humidity and temperature.

The infection rates tended to rise four days after a high pollen count. If there was no local lockdown, the infection rate increased by an average of

Bulletin Board

Gossip

MAR. 19, 2021

about 4% per 100 pollen grains in a cubic meter of air. A strict lockdown cut the increase by half.

This pollen exposure isn't just a problem for people with hay fever. It's a reaction to pollen in general. Even types of pollen that typically don't cause allergic reactions were correlated with an increase in COVID-19 infections.

What precautions can people take?

On days with high pollen counts, try to stay indoors to limit your exposure as much as possible.

When you're outdoors, wear a mask during pollen season. Pollen grains are large enough that almost any mask designed for allergies will work to keep them out. However, if you're sneezing and coughing, wear a mask that's effective against the coronavirus. If you're asymptomatic with COVID-19, all that sneezing increases your chances of spreading the virus. Mild cases of COVID-19 could also be mistaken for allergies.

Why is pollen season lasting longer?

As the climate changes, we're seeing three things that relate specifically to pollen.

One is an earlier start to pollen season. Spring changes are starting earlier, and there are signals globally of exposure to pollen earlier in the season.

Second, the overall pollen season is getting longer. The time you're exposed to pollen, from spring, which is primarily driven by tree pollen, to the summer, which is weeds and grasses, and then the fall, which is primarily ragweed, is about 20 days longer in North America now than it was in 1990. As you move toward the poles, where temperatures are rising faster, we found that the season is becoming even more pronounced.

Third, more pollen is being produced. Colleagues and I described all three changes in a paper published in February.

As climate change drives pollen counts upward, that could potentially result in greater human susceptibility to viruses.

These changes in the pollen season have been underway for several decades. When my colleagues and I looked back at as many different records of pollen keeping as we could locate since the 1970s, we found solid evidence suggesting that these shifts have been happening for at least the past 30 to 40 years.

Bulletin Board

Gossip

MAR. 19, 2021

Greenhouse gas concentrations are rising and the surface of the Earth is warming, and that's going to affect life as we know it. I've been studying climate change for 30 years. It's so endemic of the current environment that it's going to be hard to look at any medical issue without at least trying to understand whether climate change has already affected it or is going to do so.

theconversation.com, 9 March 2021

<https://www.theconversation.com>

The world wasted nearly 1 billion metric tons of food in 2019

2021-03-09

The world wasted about 931 million metric tons of food in 2019 — an average of 121 kilograms per person. That's about 17 percent of all food that was available to consumers that year, a new United Nations report estimates.

"Throwing away food de facto means throwing away the resources that went into its production," said Martina Otto, who leads the U.N. Environment Program's work on cities, during a news conference. "If food waste ends up in landfills, it does not feed people, but it does feed climate change."

Some 690 million people are impacted by hunger each year, and over 3 billion people can't afford a healthy diet. Meanwhile, lost and wasted food accounts for 8 to 10 percent of global greenhouse gas emissions. Reducing food waste could ease both of those problems, according to the Food Waste Index Report 2021 published March 4 by the U.N. Environment Program and WRAP, an environmental charity based in the United Kingdom.

Researchers analyzed food waste data from 54 countries. Most waste — 61 percent — came from homes. Food services such as restaurants accounted for 26 percent of global food waste while retail outlets such as supermarkets contributed just 13 percent. Surprisingly, food waste was a substantial problem for nearly all countries regardless of their income level, the team found. "We thought waste was predominantly a problem in rich countries," Otto said.

While the report is the most comprehensive analysis of global food waste to date, several knowledge gaps remain. The 54 countries account for

Bulletin Board

Gossip

MAR. 19, 2021

just 75 percent of the world's population, and only 23 countries provided waste estimates for their food service or retail sectors. The researchers accounted for these gaps by extrapolating values for the rest of the world from countries that did track these data. The report does not differentiate between potentially edible wasted food and inedible waste such as eggshells or bones.

Otto recommends that countries begin addressing food waste by integrating reduction into their climate strategies and COVID-19 recovery plans. "Food waste has been largely overlooked in national climate strategies," Otto said. "We know what to do, and we can take action quickly — collectively and individually."

sciencenews.org, 9 March 2021

<https://www.sciencenews.org>

Oil in the ocean photooxidizes within hours to days, new study finds

2021-03-13

A new study led by scientists at the University of Miami (UM) Rosenstiel School of Marine and Atmospheric Science demonstrates that under realistic environmental conditions oil drifting in the ocean after the DWH oil spill photooxidized into persistent compounds within hours to days, instead over long periods of time as was thought during the 2010 Deepwater Horizon oil spill. This is the first model results to support the new paradigm of photooxidation that emerged from laboratory research.

After an oil spill, oil droplets on the ocean surface can be transformed by a weathering process known as photooxidation, which results in the degradation of crude oil from exposure to light and oxygen into new by-products over time. Tar, a by-product of this weathering process, can remain in coastal areas for decades after a spill. Despite the significant consequences of this weathering pathway, photooxidation was not taken into account in oil spill models or the oil budget calculations during the Deepwater Horizon spill.

The UM Rosenstiel School research team developed the first oil-spill model algorithm that tracks the dose of solar radiation oil droplets receive as they rise from the deep sea and are transported at the ocean surface. The authors found that the weathering of oil droplets by solar light occurred within hours to days, and that roughly 75 percent of the photooxidation during the Deepwater Horizon oil spill occurred on the same areas where

Tar, a by-product of this weathering process, can remain in coastal areas for decades after a spill.

Bulletin Board

Gossip

MAR. 19, 2021

chemical dispersants were sprayed from aircraft. Photooxidized oil is known to reduce the effectiveness of aerial dispersants.

“Understanding the timing and location of this weathering process is highly consequential. said Claire Paris, a UM Rosenstiel School faculty and senior author of the study. “It helps directing efforts and resources on fresh oil while avoiding stressing the environment with chemical dispersants on oil that cannot be dispersed.”

“Photooxidized compounds like tar persist longer in the environment, so modeling the likelihood of photooxidation is critically important not only for guiding first response decisions during an oil spill and restoration efforts afterwards, but it also needs to be taken into account on risk assessments before exploration activities” added Ana Carolina Vaz, assistant scientist at UM’s Cooperative Institute for Marine and Atmospheric Studies and lead author of the study.

The study, titled “A Coupled Lagrangian-Earth System Model for Predicting Oil Photooxidation,” was published online on Feb 19, 2021 in the journal *Frontiers in Marine Science*. The authors of the paper include: Ana Carolina Vaz, Claire Beatrix Paris and Robin Faillettaz.

phys.org, 13 March 2021

<https://www.phys.org>

Ancient hippo-size reptile was a quick and ferocious killing machine

2021-03-09

A hippopotamus-size predator that lived 265 million years ago was unexpectedly speedy for such a bulky beast.

Scientists previously viewed the dinosaur-like reptile *Anteosaurus* as slow and plodding because of its massive, heavy head and bones. However, a new analysis of the animal’s skull proved otherwise, revealing adaptations that would have made *Anteosaurus* a fast-moving juggernaut.

With this deadly combination of speed and power — along with a mouthful of bone-crushing teeth — *Anteosaurus* would have been one of the most fearsome apex predators on the African continent during the middle part of the Permian period (299 million to 251 million years ago), according to a new study.

PLAY SOUND

Bulletin Board

Gossip

MAR. 19, 2021

Anteosaurus belonged to a reptile family that predated dinosaurs, known as dinocephalians, and they all died out about 30 million years before the first dinosaurs appeared. Dinocephalians were also part of a larger group of animals called therapsids, which includes the ancestors of mammals.

“Dinocephalians were among the first herbivorous and carnivorous species that dominated terrestrial ecosystems,” said lead study author Julien Benoit, a senior researcher at the Evolutionary Studies Institute at the University of the Witwatersrand (Wits University) in Johannesburg, South Africa.

What’s more, dinocephalians were some of the earliest amniotes — animals that hatch from eggs laid on land or retained inside the mother’s body — to evolve very large body size, according to the study. Many dinocephalians also had sturdy skulls with reinforced horns, buffers and bumps, suggesting that the animals may have used their heavy heads as battering rams.

Heavy ... and amphibious?

Because *Anteosaurus*’ skeleton was so massive, researchers previously hypothesized that it was a slow-moving animal that likely ambushed its prey, Benoit told Live Science in an email.

“Some authors even suggested that it might have been amphibious because it was just too heavy to support its weight on land — similar to what used to be imagined about dinosaurs,” Benoit said. “Our study suggests it is quite the opposite.”

Anteosaurus had a weighty, knobby skull with a prominent crest on the snout, and Benoit and his co-authors questioned if *Anteosaurus* was a head-butter, like some of its dinocephalian relatives. To find out, they scanned the skull of a juvenile *Anteosaurus magnificus* from the Karoo desert region in South Africa.

They used X-ray microtomography (micro-CT) to create high-resolution images that revealed the interior of the skull in exceptional detail and then used those images to reconstruct the skull and its long-gone internal structures as digital 3D models.

Their scans provided the first-ever glimpse of an *Anteosaurus*’ inner ear — and it was definitely not the inner ear of a head-butting animal, Benoit said.

Dinocephalians were also part of a larger group of animals called therapsids, which includes the ancestors of mammals.

Bulletin Board

Gossip

MAR. 19, 2021

“When the skull is adapted to head butting, the inner ear is tilted backward because of a reorientation of the braincase to absorb head-to-head combat stress,” Benoit said. But *A. magnificus* lacked that adaptation, so it probably didn’t use its head for ramming.

“Instead, it would have used its massive canines for fighting,” Benoit said.

An agile killer

The scientists also found surprising clues about *Anteosaurus*’ abilities by reconstructing and measuring the dimensions of its inner ear canal, which is a feature associated with balance, and lobes in its cerebellum called the flocculi, which assist with agility and help predators lock their eyes on their prey. The shapes of these structures resembled those found in predators such as cats and velociraptors, hinting that *Anteosaurus* had a nervous system adapted to catching fast-moving prey, Benoit said.

“When you contemplate the bones of this animal, they look so heavy and massive that this really came up as a surprise,” he said. “I guess this comes in part from the misconception that fossilized bones are so heavy, it is hard to imagine that they were once light and pulled by muscles powerful enough to make them move.”

Superior swiftness and agility would have enabled *Anteosaurus* to prey on another group of big-skulled and formidable Permian reptiles known as therocephalians, or “beast-heads,” placing it at the top of the food chain, according to the study. And this is just the beginning of what researchers are yet to discover about the strange reptiles that came before the dinosaurs, Benoit said.

“Soon we will be capable of comparing the brain and inner ear of *Anteosaurus* to many of its close relatives,” he said. “This will shed new light on the interactions between animals of an entirely extinct ecosystem.”

The findings were published online Feb. 18 in the journal *Acta Palaeontologica Polonica*.

Originally published on Live Science.

livescience.com, 9 March 2021

<https://www.livescience.com>

Bulletin Board

Gossip

MAR. 19, 2021

More twins are being born than ever before

2021-03-13

Twin births are multiplying, a new study finds. Worldwide, more twins are being born now than ever before.

Since the 1980s, the rate of twin births worldwide has increased by more than 30%, from 9 twin births per 1,000 deliveries in 1980-1985, to 12 twin births per 1,000 deliveries in 2010-2015.

What’s more, the absolute number of twin deliveries increased by 42% during this period — from 1.1 million twin deliveries in the early 1980s to 1.6 million deliveries in the early 2010s. For comparison, the total number of births worldwide increased by only 8% during the same period.

Medically-assisted reproduction, which includes in vitro fertilization (IVF), or when an egg is fertilized with sperm in a lab dish and transferred to the uterus, may largely explain this rise, the authors said. IVF increases the chance of twins if more than one embryo is transferred.

PLAY SOUND

However, some regions of the world may have reached “peak twinning” as fertility specialists reduce the number of embryos transferred with IVF.

“The relative and absolute numbers of twins in the world are higher than they have ever been since the mid-twentieth century, and this is likely to be an all-time high,” study co-author Christiaan Monden, a professor of sociology at the University of Oxford in the United Kingdom, said in a statement. “This is important as twin deliveries are associated with higher death rates among babies and children and more complications for mothers and children during pregnancy, and during and after delivery.”

More women are having children at a later age, which may also partly explain the rise of twin births, because older women are more likely to conceive twins, the authors said.

More multiples

The study researchers analyzed information on twin births from 165 countries between 2010 and 2015. For 112 of these countries, the researchers also obtained information on twin births between 1980 and 1985, which allowed for a comparison between these periods.

The researchers found that over the three-decade period, the twin birth rate increased by more than 10% in 74 out of the 112 countries.

What’s more, the absolute number of twin deliveries increased by 42% during this period — from 1.1 million twin deliveries in the early 1980s to 1.6 million deliveries in the early 2010s.

Bulletin Board

Gossip

MAR. 19, 2021

The increase is mainly due to increases in dizygotic, or fraternal, twins; rates of monozygotic, or identical, twins have remained about the same worldwide, with about 4 identical twin births per 1,000 deliveries.

On a continent level, North America saw the biggest rise in twin births, with a 71% increase in the rate of twin births over the three-decade period, followed by Europe, with a 58% rise, and Oceania, with a 46% rise.

Africa has the highest rates of twins worldwide, with about 17 twin births per 1,000 deliveries; but the rate remained mostly unchanged throughout the three-decade study period. It's thought that some populations in Africa may be more genetically prone to having twins, compared with populations in other parts of the world.

"In both periods, Africa had the highest twinning rates and there was no significant increase over time. However, Europe, North America and the Oceanic countries are catching up rapidly," Monden said.

But there is a large difference in the chances of survival for twins born in wealthy countries versus low-income countries.

"More attention needs to be paid to the fate of twins in low- and middle-income countries. In sub-Saharan Africa, in particular, many twins will lose their co-twin in their first year of life, some two to three hundred thousand each year," study co-author Jeroen Smits, a professor of comparative economic and human development at Radboud University in the Netherlands, said in the statement.

The researchers call for better tracking of twin births, particularly in lower income countries, as reliable data are lacking for many of those areas, which is the main limitation of the study.

Future studies are needed to determine if rates of twinning have indeed peaked in high income countries; and how increases in medically-assisted reproduction in low and middle income countries will affect the rates of twins in those areas.

The new study was published Thursday (March 11) in the journal *Human Reproduction*.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 13 March 2021

<https://www.livescience.com>

Bulletin Board

Gossip

MAR. 19, 2021

6 months of summer could be the norm by 2100, study finds

2021-03-12

Global warming will change the lengths of the four seasons, a new study suggests, potentially making six-month-long summers the norm in the Northern Hemisphere by the year 2100.

In contrast, winters could last less than two months a year, while spring and autumn similarly shorter. These drastic seasonal changes would have wide-reaching impacts on the world, disturbing agriculture and animal behavior, increasing the frequency of heat waves, storms and wildfires, and ultimately posing "increased risks to humanity," the study authors wrote.

"Tropical mosquitoes carrying viruses are likely to expand northward and bring about explosive outbreaks during longer and hotter summers," the researchers wrote in their study, published Feb. 19 in the journal *Geophysical Research Letters*.

These and other potential impacts "heighten the urgency of understanding" how the seasons morph with climate change, and whether that transformation will continue in the future.

To find out, the study authors looked at historical daily temperature data from 1952 to 2011 in the Northern Hemisphere. Specifically, they wanted to see how the onset of new seasons changed from year to year. The team defined the start of summer as the onset of temperatures in the hottest 25% of temperatures, averaged from 1952 to 2011. They defined winter as the start of temperatures in the coldest 25% from the same period, while autumn and spring were in between.

The researchers found that, on average, summer lengthened from 78 to 95 days between 1952 and 2011. Meanwhile, winter shrank from 76 to 73 days. The transition seasons shrank as well, with spring shortening from 124 to 115 days and autumn from 87 to 82 days. Average temperatures changed accordingly during this period; summer and winter both became warmer.

The team also used climate models to predict how much the seasons are likely to change in the future. Under the business-as-usual scenario (that is, if no efforts are made to mitigate global warming), spring and summer will start a month earlier in 2100 than they did in 2011, while fall and winter will start half a month later. As a result, the Northern Hemisphere

In contrast, winters could last less than two months a year, while spring and autumn similarly shorter.

Bulletin Board

Gossip

MAR. 19, 2021

will spend more than half the year in summer — and average summer temperatures are only expected to rise.

This seasonal shift would impact everything from when birds migrate to when crops grow, touching virtually every aspect of Earth's biosphere, the team wrote. Preventing the most jarring changes to our planet's seasons in the future begins with drastically reducing carbon emissions now.

PLAY SOUND

Originally published on Live Science.

livescience.com, 12 March 2021

<https://www.livescience.com>

Tool to modify sugars on “undruggable” proteins may uncover new treatments

2021-03-15

Sugars found on cells, such as O-linked N-acetylglucosamine (O-GlcNAc), are notoriously difficult to study. Current tools act by either turning on or off all the O-GlcNAc sugars in a cell or by turning on or off a single sugar on one amino acid on one protein. These techniques do not offer insight on what O-GlcNAc molecules are doing to a protein as a whole, which is necessary information to connect O-GlcNAc to disease.

Now, researchers at Harvard University have designed a new, highly-selective, O-GlcNAc pencil and eraser—tools that can add or remove the sugar from a protein with no off-target effects—to examine exactly what these sugars are doing. The O-GlcNAc eraser, consisting of a nanobody-fused split O-GlcNAcase, can perform selective deglycosylation of a target protein in cells. Because these sugars are commonly found on proteins that are considered “undruggable,” this work is critical to engineer new treatments for disease.

This work is published in Nature Chemical Biology in the paper, “Target protein deglycosylation in living cells by a nanobody-fused split O-GlcNAcase.”

“We can now start studying particular proteins and see what happens when you add or remove the sugar,” said Daniel Ramirez, a PhD candidate in biological and biomedical sciences in the Graduate School of Arts and Sciences at Harvard, co-author on the current paper, and designer of the

Bulletin Board

Gossip

MAR. 19, 2021

original O-GlcNAc pencil. “This is turning out to be very important for a lot of chronic diseases like cancer and diabetes and Alzheimer’s.”

“With the protein-level approach, we’re filling in an important piece that was missing,” said Christina Woo, PhD, an associate professor of chemistry and chemical biology at Harvard University, who led the study. About 85% of proteins, including those associated with Alzheimer’s and Parkinson’s, are beyond the reach of current drugs.

How did they do it? After an optimization process, they identified a split O-GlcNAcase with reduced activity that selectively removed O-GlcNAc from the target protein when directed by a nanobody. Then, the authors noted, they “demonstrated the generality of the nanobody-fused split O-GlcNAcase using four nanobodies against five target proteins and use the system to study the impact of O-GlcNAc on the transcription factors c-Jun and c-Fos.”

“Once you have any protein of interest,” said Yun Ge, PhD, a postdoctoral fellow in the Woo lab and first author on the paper, “you can apply this tool on that protein and look at the outcomes directly.” Ge engineered the O-GlcNAc eraser, which, like the pencil, uses a nanobody as a protein homing device. The tool is adaptable, too; as long as a nanobody exists for a protein of choice, the tool can be modified to target any protein for which a homing nanobody exists.

The nanobody is a crucial component, but it has limitations: Whether or not it remains stuck to the target protein is still in question, and the molecule could alter the function or structure of the protein once stuck. If cellular changes can’t be definitively linked to the sugar on the protein, that muddies the data.

To skirt these potential limitations, the team engineered their pencils and erasers to be “catalytically dead,” said Woo. The neutered enzymes won’t make unwanted changes along the way to their target protein. And they can both add and remove sugars, unlike previous tools, which cause permanent changes. Once they connect a specific protein function to O-GlcNAc, they can then use those tools to zoom in and locate exactly where those sugars are latching onto and modifying the protein.

Already, a few of the Woo lab’s collaborators are using the tool to study O-GlcNAc in live animals. Next, the team plans to tweak their tool to achieve even greater control. With optogenetics, for example, they could switch sugars on or off with just a flash of light. Swapping out nanobodies for small molecules, they could edge closer to new treatments. They’re also

“This is turning out to be very important for a lot of chronic diseases like cancer and diabetes and Alzheimer’s.”

Bulletin Board

Gossip

MAR. 19, 2021

designing an eraser for the eraser, as a kill switch, and plan to incorporate nanobodies that can target a naturally-occurring protein (for this study, they tagged proteins so the nanobody could find them). "We're basically trying to make the system more natural and function the way the cell does," said Ramirez.

Woo also plans to investigate how O-GlcNAc may influence transcription factors. If O-GlcNAc plays a role in that process, the sugars could be engineered to study and regulate gene function, too.

"We really don't know what people are going to find once we give them these tools," said Ramirez. The tool may be new, but the potential is great: "We're on the iPhone 1, basically," he continued, "but we're already working on the next couple generations."

genengnews.com, 15 March 2021

<https://www.genengnews.com>

Stable 2D boron material created for the first time

2021-03-15

Researchers at Northwestern University in the US have synthesised atomically thin hydrogenated boron, dubbed borophane, for the first time.¹ They created it by reacting unstable borophene – a single-atom-thick sheet of boron that is stronger, lighter and more flexible than graphene – with atomic hydrogen to produce a 2D material that was stable in air for days.

Borophene, which was first synthesised in 2015,² has captured the attention of researchers because of properties such as its high mechanical strength, flexibility and superconductivity. These characteristics could have exciting applications for batteries, electronics and quantum computing. However, borophene immediately oxidises in air, losing its conductive properties, so cannot exist outside of an ultrahigh vacuum chamber. This has severely hampered the exploration of borophene and its properties.

'The boron atoms in borophene are highly susceptible to further chemical reactions,' explained Mark Hersam, who led the research. 'We found that once the boron atoms are bonded with hydrogen, they will no longer react with oxygen when in open air.' He and collaborators created borophene for the first time five years ago.

While the newly synthesised borophane has the same promising properties as borophene, it can be explored in the real world as it's stable

Bulletin Board

Gossip

MAR. 19, 2021

outside of a vacuum. 'Materials synthesis is a bit like baking,' Hersam said. 'By sharing the optimal recipe for borophane with the world, we anticipate that its use will rapidly proliferate.'

chemistryworld.com, 15 March 2021

<https://www.chemistryworld.com>

Borophene, which was first synthesised in 2015,² has captured the attention of researchers because of properties such as its high mechanical strength, flexibility and superconductivity.

Bulletin Board

Curiosities

MAR. 19, 2021

Saudi Arabia's wants to build a 105-mile-long 'Line' city in the desert

2021-03-10

Saudi Arabia has a bold vision for its newest city: a 106-mile-long (170 kilometers) "Line" without cars or long commutes. But urban design experts are skeptical, to say the least.

"Awful. Nightmare," said Emily Talen, an urban design researcher at The University of Chicago.

Despite the flashy announcement of The Line, the technology for such a city doesn't exist yet, and building massive new cities from scratch is fraught with challenges.

"The history of so-called megaprojects is not pretty," said Stephen Wheeler, a landscape architect and environmental design professor at the University of California, Davis. "Usually, they don't quite turn out the way the original visionaries intend, they often fall prey to economic conditions or other people's ideas of what should happen, or they wind up costing vastly more than expected." **PLAY SOUND**

Design of the line

So far, The Line exists only as a website and a press announcement made by Saudi Crown Prince Mohammed bin Salman on Jan. 10. The proposal calls for the aforementioned 106-mile strip of development in Neom, a planned city in northwestern Saudi Arabia. The Saudi government touts the area as undeveloped, but it is in fact home to 20,000 members of the Huwaitat (also spelled Howeitat) tribe, who have protested being evicted for the planned megacity, according to The Guardian.

The Line would be built in three layers: a surface-level pedestrian layer full of parks and open spaces, a lower "service" layer and an even deeper transportation "spine" that would consist of "ultra-high-speed transit." The proposal claims that all daily services would be walkable within 5 minutes of each node on the line and that commutes between nodes on the high-speed transit would take no more than 20 minutes.

According to some experts, however, those goals are unfeasible. The plan for a miles-long line with a width that can be walked in only 5 minutes is questionable, said Elizabeth Plater-Zyberk, a professor of architecture at the University of Miami and a founding partner at DPZ CoDesign, an urban design and architecture firm. To support that level of public transport,

Bulletin Board

Curiosities

MAR. 19, 2021

Plater-Zyberk told Live Science, the line would require larger nodes capable of holding more people.

"If there's only a few hundred people at every stop, you're not going to economically sustain that investment in that infrastructure," she said.

Keeping The Line linear would also require heavy regulation, Plater-Zyberk said, as cities tend to expand outward as they grow. This is why "hub-and-spoke" transit systems tend to be more common; they allow arms of transit to connect to one another without requiring travel all the way back to a central transit station. Even as they advance promising ideas such as walkability, The Line's designers seem to dispense with historical knowledge about what works well when designing transit, Plater-Zyberk said.

"There are many people now worldwide who could assist in elaborating the idea to make it workable," she said. "We have data on what kind of support transit systems need in order to be sustainable."

However, it's also unclear if the technology for The Line's transit system exists yet. Traveling 106 miles in 20 minutes would require a speed of 318 mph (512 km/h), which outpaces high-speed rail by a long shot. Eurostar trains in Europe travel at about 199 mph (320 km/h); and while some of China's high-speed rail trains reach speeds of 236 mph (380 km/h), in practice, they average about the same speeds as Eurostar. Underground Hyperloop pods, like those in development by Virgin and SpaceX, could theoretically manage the journey, but that technology is still at least a decade away from use. The fastest Hyperloop tests so far have topped out at 288 mph (463 km/h) without passengers. Only one company, Virgin, has tested the technology with passengers, at speeds of 107 mph (172 km/h).

Planning cities

If the future of tech is a problem for The Line, so is the past. The Saudi proposal isn't the first time a linear city has been suggested. In 1882, Spanish urban planner Arturo Soria y Mata proposed the Ciudad Lineal, or Linear City, which would start with a railway or roadway and have all buildings and other parts of the city constructed along this line. The district of Ciudad Lineal in Madrid was built with this idea in mind, and its main thoroughfare is named after Soria y Mata — but the neighborhood does not stand alone from the rest of Madrid.

"It just kind of became sprawl," Talen told Live Science.

Bulletin Board

Curiosities

MAR. 19, 2021

Brasilia, the capital of Brazil, was originally planned as the ideal city, shaped like an airplane with government buildings lining the fuselage. But Brasilia has been criticized as not particularly livable, with few mixed-use neighborhoods and little housing within the city center for lower-income families. This meant long commutes for many who worked in the city.

“Usually, we’re far better off making thoughtful incremental improvements to existing cities than trying to design entirely new cities from scratch,” Wheeler told Live Science. Often, when communities are planned from scratch, “we wind up with kind of a sterile, master-planned community that doesn’t have the richness of something that evolves over time.”

A far more sustainable strategy, Talen said, is to fix existing cities.

“Should all these resources be spent on building anew in the middle of a desert?” Talen said. “How does that make sense when you have plenty of urban problems all around you that need repairing?”

What’s more, many pie-in-the-sky built-from-scratch cities cater not to locals, but to tourists or second-home owners. The Sustainable City in Dubai, for example, is touted as the first net-zero-energy city but caters heavily to foreigners buying second homes. Similarly, The Line’s press materials boast that Neom is within a 4-hour plane trip for 40% of the world’s population.

“Whether that is a sustainable lifestyle is pretty debatable,” Wheeler said.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 10 March 2021

<https://www.livescience.com>

How is this horse feeling? New mobile brain wave reader could tell

2021-03-09

The famed stallion Black Beauty felt joy, excitement, and even heartbreak—or so he tells us in the 1877 novel that bears his name. Now, scientists say they’ve been able to detect feelings in living animals by getting them straight from the horse’s mouth—or in this case, its head. Researchers have devised a new, mobile headband that detects brain waves in horses, which could eventually be used with other species.

Bulletin Board

Curiosities

MAR. 19, 2021

“This is a real breakthrough,” says Katherine Houpt, a veterinary behaviorist at Cornell University who was not involved with the work. The device, she says, “gets into the animals’ minds” with objectivity and less guesswork.

Ethologist Martine Hausberger had the idea while investigating whether stressed horses had a harder time learning to open a sliding door over a food box. (Spoiler alert: They do.) Hausberger, of the University of Rennes, noticed some of the animals—specifically, those living in cramped spaces—were paying less attention to the lessons. Were they depressed?

An electroencephalogram (EEG) could theoretically pick up on such a mental state. Scientists have used the devices, which record waves of electrical impulses in the brain, since the early 1900s to study epilepsy and sleep patterns. More recently, they’ve discovered that certain EEG waves can signal depression, anxiety, and even contentedness in humans. EEG studies in rodents, farm animals, and pets, meanwhile, have revealed how they react to being touched by a human or undergoing anesthesia. But so far, no one had found a way to record brain waves in animals while they move around.

That’s because EEG recordings require placing electrodes in specific positions on the head and running cables from them to a recording machine. As a result, animals are either restrained or sedated during measurements. And for readings to be accurate, scientists have to either shave the animal’s head or surgically implant the electrodes under its scalp.

Hausberger turned to her Rennes colleague, neurophysicist Hugo Cousillas. He started with wearable EEG headbands for people, which promise to show how well we’re sleeping or meditating by tracking brain waves.

Cousillas spent the next 6 years developing a device for horses. Unlike EEGs for people, which can have dozens or even hundreds of electrodes, the horse headband only has four—plenty for picking up waves from both hemispheres of their peach-size brains. The device transmits its readings up to 20 yards, and the animal’s hair remains intact—thanks to electrodes nestled in spring-loaded, gel-filled pockets with tiny needles poking gently against the skin.

Cousillas and Hausberger then teamed up with Rennes ethologist Mathilde Stomp to take EEG recordings of 18 horses. Half lived in individual stalls in a classic, confined stable, whereas the other half roamed with herds on open pastures.

Researchers have devised a new, mobile headband that detects brain waves in horses, which could eventually be used with other species.

Bulletin Board

Curiosities

MAR. 19, 2021

The two groups had very different EEG profiles. Horses in stables showed an average of 2.5 times more right-hemisphere “gamma” waves than those in open fields. In people, such waves are often a sign of anxiety, distraction, or depression. The horses that spent most of their time out in the open, meanwhile, showed twice as many left-hemisphere “theta” waves on average—generally a sign of a calm and attentive mind, the team reports this month in *Applied Animal Behaviour Science*. “What’s really exciting about these results is that they give us a rare measure of ‘happiness,’ so to speak,” Hausberger says.

Konstanze Krueger, a cognitive ecologist at the University of Nürtingen-Geislingen, isn’t so sure. Brain wave interpretations for humans don’t necessarily translate to other species, she says.

Still, the new approach is a “fascinating” way to measure captive animals’ mental health, says Greg Vicino, an animal behaviorist at the San Diego Zoo. To monitor behavior and mood in hundreds of animals, his team watches each one for hours; the headband may be a promising alternative.

Getting a headband on a tiger might seem terrifying, Vicino says, but most of the animals at his zoo are trained for basic handling and could probably get used to wearing such a device. “It’s not a deal breaker.”

[sciencemag.org](https://www.sciencemag.org), 9 March 2021

<https://www.sciencemag.org>

The device that reverses CO2 emissions

2021-03-12

The year is 2050. Walk out of the Permian Basin Petroleum Museum in Midland, Texas, and drive north across the sun-baked scrub where a few remaining oil pumpjacks nod lazily in the heat, and then you’ll see it: a glittering palace rising out of the pancake-flat ground. The land here is mirrored: the choppy silver-blue waves of an immense solar array stretch out in all directions. In the distance, they lap at a colossal grey wall five storeys high and almost a kilometre long. Behind the wall, you glimpse the snaking pipes and gantries of a chemical plant.

As you get closer you see the wall is moving, shimmering – it is entirely made up of huge fans whirring in steel boxes. You think to yourself that it looks like a gigantic air conditioning unit, blown up to incredible proportions. In a sense, that’s exactly what this is. You’re looking at a direct air capture (DAC) plant, one of tens of thousands like it across the globe. Together, they’re trying to cool the planet by sucking carbon dioxide out

Bulletin Board

Curiosities

MAR. 19, 2021

of the air. This Texan landscape was made famous for the billions of barrels of oil pulled out of its depths during the 20th Century. Now the legacy of those fossil fuels – the CO2 in our air – is being pumped back into the emptied reservoirs.

If the world is to meet Paris Agreement goals of limiting global warming to 1.5C by 2100, sights like this may be necessary by mid-century.

But step back for a moment to 2021, to Squamish, British Columbia where, against a bucolic skyline of snowy mountains, the finishing touches are being put to a barn-sized device covered in blue tarpaulin. When it becomes operational in September, Carbon Engineering’s prototype direct air capture plant will begin scrubbing a tonne of CO2 from the air every year. It is a small start, and a somewhat larger plant in Texas is in the works, but this is the typical scale of a DAC plant today.

“We have a climate change problem and it’s caused by an excess of CO2,” says Carbon Engineering chief executive Steve Oldham. “With DAC, you can remove any emission, anywhere, from any moment in time. It’s very powerful tool to have.”

Most carbon capture focuses on cleaning emissions at the source: scrubbers and filters on smokestacks that prevent harmful gases reaching the atmosphere. But this is impractical for small, numerous point sources like the planet’s billion or so automobiles. Nor can it address the CO2 that is already in the air. That’s where direct air capture comes in.

If the world wants to avoid catastrophic climate change, switching to a carbon neutral society is not enough. The Intergovernmental Panel on Climate Change (IPCC) has warned that limiting global warming to 1.5C by 2100 will require technologies such as DAC for “large-scale deployment of carbon dioxide removal measures” – large-scale meaning many billions of tonnes, or gigatonnes, each year. Elon Musk recently pledged \$100m (£72m) to develop carbon capture technologies, while companies such as Microsoft, United Airlines and ExxonMobil are making billion-dollar investments in the field.

“Current models suggest we’re going to need to remove 10 gigatonnes of CO2 per year by 2050, and by the end of the century that number needs to double to 20 gigatonnes per year,” says Jane Zelikova, a climate scientist at the University of Wyoming. Right now, “we’re removing virtually none. We’re having to scale from zero.”

Bulletin Board

Curiosities

MAR. 19, 2021

Carbon Engineering's plant in Squamish is designed as a testbed for different technologies. But the firm is drawing up blueprints for a much larger plant in the oil fields of west Texas, which would fix 1 million tonnes of CO₂ annually. "Once one is done, it's a cookie cutter model, you simply build replicas of that plant," says Oldham. Yet he admits the scale of the task ahead is dizzying. "We need to pull 800 gigatonnes out of the atmosphere. It's not going to happen overnight."

Blue-sky thinking

The science of direct air capture is straightforward. There are several ways to do it, but the one that Carbon Engineering's system uses fans to draw air containing 0.04% CO₂ (today's atmospheric levels) across a filter drenched in potassium hydroxide solution – a caustic chemical commonly known as potash, used in soapmaking and various other applications. The potash absorbs CO₂ from the air, after which the liquid is piped to a second chamber and mixed with calcium hydroxide (builder's lime). The lime seizes hold of the dissolved CO₂, producing small flakes of limestone. These limestone flakes are sieved off and heated in a third chamber, called a calciner, until they decompose, giving off pure CO₂, which is captured and stored. At each stage, the leftover chemical residues are recycled back in the process, forming a closed reaction that repeats endlessly with no waste materials.

With global carbon emissions continuing to rise, the climate target of 1.5C is looking less and less likely without interventions like this.

"The number of things that would have to happen without direct air capture are so stretching and multiple it's highly unlikely we can meet the Paris Agreements without it," says Ajay Gambhir, senior researcher at the Imperial College Grantham Institute for Climate Change and an author of a 2019 paper on the role of DAC in climate mitigation.

The IPCC does present some climate-stabilising models that don't rely on direct air capture, but Gambhir says these are "extremely ambitious" in their assumptions about advances in energy efficiency and people's willingness to change their behaviour.

"We're past the point where reducing emissions needed to take place," says Zelikova. "We're locking in our reliance on DAC more and more."

DAC is far from the only way carbon can be taken out of the atmosphere. Carbon can be removed naturally through land use changes such as restoring peatland, or most popularly, planting forests. But this is slow

Bulletin Board

Curiosities

MAR. 19, 2021

and would require huge tracts of valuable land – foresting an area the size of the United States, by some estimates, and driving up food prices five-fold in the process. And in the case of trees, the carbon removal effect is limited, as they will eventually die and release their stored carbon, unless they can be felled and burned in a closed system. (Read more about why planting trees doesn't always help with climate change)

The scale of the challenge for carbon removal using technologies like DAC, rather than plants, is no less gargantuan. Gambhir's paper calculates that simply keeping pace with global CO₂ emissions – currently 36 gigatonnes per year – would mean building in the region of 30,000 large-scale DAC plants, more than three for every coal-fired power station operating in the world today. Each plant would cost up to \$500m (£362m) to build – coming in at a cost of up to \$15 trillion (£11 tn).

Every one of those facilities would need to be stocked with solvent to absorb CO₂. Supplying a fleet of DAC plants big enough to capture 10 gigatonnes of CO₂ every year will require around four million tonnes of potassium hydroxide, the entire annual global supply of this chemical one and a half times over.

And once those thousands of DAC plants are built, they also need power to run. "If this was a global industry absorbing 10 gigatonnes of CO₂ a year, you would be expending 100 exajoules, about a sixth of total global energy," says Gambhir. Most of this energy is needed to heat the calciner to around 800C – too intense for electrical power alone, so each DAC plant would need a gas furnace, and a ready supply of gas.

Costing the planet

Estimates of how much it costs to capture a tonne of CO₂ from the air vary widely, ranging from \$100 to \$1,000 (£72 to £720) per tonne. Oldham says that most figures are unduly pessimistic – he is confident that Climate Engineering can fix a tonne of carbon for as little as \$94 (£68), especially once it becomes a widespread industrial process.

A bigger issue is figuring out where to send the bill. Incredibly, saving the world turns out to be a pretty hard sell, commercially speaking. Direct air capture does result in one valuable commodity, though: thousands of tonnes of compressed CO₂. This can be combined with hydrogen to make synthetic, carbon-neutral fuel. That could then be sold or burned in the gas furnaces of the calciner (where the emissions would be captured and the cycle continue once again).

Bulletin Board

Curiosities

MAR. 19, 2021

Surprisingly, one of the biggest customers for compressed CO₂ is the fossil fuel industry.

As wells run dry, it's not uncommon to squeeze the remaining oil out of the ground by pressuring the reservoir using steam or gas in a process called enhanced oil recovery. Carbon dioxide is a popular choice for this, and comes with additional benefit of locking that carbon underground, completing the final stage of carbon capture and storage. Occidental Petroleum, which has partnered with Carbon Engineering to build a full-scale DAC plant in Texas, uses 50 million tonnes of CO₂ every year in enhanced oil recovery. Each tonne of CO₂ used in this way is worth about \$225 (£163) in tax credits alone.

It's perhaps fitting that the CO₂ in our air is eventually being returned underground to the oil fields from whence it came, although maybe ironic that the only way to finance this is in the pursuit of yet more oil. Occidental and others hope that by pumping CO₂ into the ground, they can drastically reduce the carbon impact of that oil: a typical enhanced-recovery operation sequesters one tonne of CO₂ for every 1.5 tonnes it ultimately releases in fresh oil. So while the process reduces the emissions associated with oil, it doesn't balance the books.

Though there are other uses that may become more commercially viable. Another direct air capture company, Climeworks, has 14 smaller scale units in operation sequestering 900 tonnes of CO₂ a year, which it sells to a greenhouse to enhance the growth of pickles. It's now working on a longer-term solution: a plant under construction in Iceland will mix captured CO₂ with water and pump it 500-600m (1,600-2,000ft) underground, where the gas will react with the surrounding basalt and turn to stone. To finance this, it offers businesses and citizens the ability to buy carbon offsets, starting at a mere €7 (£6) per month. Can the rest of the world be convinced to buy in?

"DAC is always going to cost money, and unless you're paid to do it, there is no financial incentive," says Chris Goodall, author of *What We Need To Do Now: For A Zero Carbon Future*. "Climeworks can sell credits to virtuous people, write contracts with Microsoft and Stripe to take a few hundred tonnes a year out of the atmosphere, but this needs to be scaled up a millionfold, and that requires someone to pay for it.

"There are subsidies for electric cars, cheap financing for solar plants, but you don't see these for DAC," says Oldham. "There is so much focus on emission reduction, but there isn't the same degree of focus on the rest of

Bulletin Board

Curiosities

MAR. 19, 2021

the problem, the volume of CO₂ in the atmosphere. The big impediment for DAC is that thinking isn't in policy."

Zelikova believes that DAC will follow a similar path to other climate technologies, and become more affordable. "We have well-developed cost curves showing how technology can go down in cost really quickly," says Zelikova. "We surmounted similar hurdles with wind and solar. The biggest thing is to deploy them as much as possible. It's important for government to support commercialisation – it has a role as a first customer, and a customer with very deep pockets."

Goodall advocates for a global carbon tax, which would make it expensive to emit carbon unless offsets were purchased. But he recognises this is still a politically unpalatable option. Nobody wants to pay higher taxes, especially if the externalities of our high-energy lifestyles – increasing wildfires, droughts, floods, sea level rise – are seen as being shouldered by somebody else.

Zelikova adds we also need broader conversation in society about how much these efforts should cost. "There is an enormous cost in climate change, in induced or exacerbated natural disasters. We need to do away with idea that DAC should be cheap."

Risk and reward

Even if we agree to build 30,000 industrial scale DAC plants, find the chemical materials to run them, and the money to pay for it all, we won't be out of the woods yet. In fact, we might end up in a worse position than before, thanks to a phenomenon known as mitigation deterrence.

"If you think DAC is going to be there in the medium- to long-term, you will not do as much near-term emissions reduction," explains Gambhir. "If the scale-up goes wrong – if it turns out to be difficult to produce the sorbent, or that it degrades more quickly, if it's trickier technologically, if turns out to be more expensive than expected, then in a sense by not acting quickly in the near-term, you've effectively locked yourself into a higher temperature pathway."

Critics of DAC point out that much of its appeal lies in the promise of a hypothetical technology that allows us to continue living our carbon-rich lifestyles. Yet Oldham argues that for some hard-to-decarbonise industries, such as aviation, offsets that fund DAC might be the most viable option. "If it's cheaper and easier to pull carbon out of air than to stop going up in the air, maybe that is what DAC plays in emission control."

Bulletin Board

Curiosities

MAR. 19, 2021

Gambhir argues that it's not an "either-or" situation. "We need to rapidly reduce emissions in the near-term, but at same time, determinedly develop DAC to work out for sure if it's going to be there for us in the future." Zelikova agrees: "It's a 'yes, and' situation," she says. "DAC is a critical tool to balance out the carbon budget, so what we can't eliminate today can be removed later."

As Oldham seeks to scale up Carbon Engineering, the biggest fundamental factor is proving large scale DAC is "feasible, affordable and available". If he's successful, the future of our planet's climate may once again be decided in the oil fields of Texas.

bbc.com, 12 March 2021

<https://www.bbc.com>

String of code sells for \$69 million

2021-03-12

A digital collage just sold for more than \$69 million at an online auction, according to news reports.

The artwork was produced by digital artist Mike Winkelmann, also known as Beeple, and is a composite of 5,000 individual drawings, according to the auction house Christie's. Winkelmann began creating the work in May 2007, when he launched a project called "Everydays," in which he committed to producing and posting a new piece of art online every day.

After 5,000 straight days of art-making — more than 13 years — Winkelmann compiled the images into a collage called "Everydays: The First 5000 Days." And on Thursday (March 11), the piece sold for \$69,346,250 at Christie's. Bidding opened on Feb. 25 at \$100.

The work sold as a non-fungible token (NFT), meaning the buyer now owns the work as a unique string of code that verifies its authenticity, NBC News reported. Essentially, the NFT ties the artwork — in this case, an image file — to unique identification codes and metadata, all stored and traded on blockchain, the technology behind cryptocurrencies like Bitcoin, according to Investopedia.

The Winkelmann artwork will "be delivered directly from Beeple to the buyer, accompanied by a unique NFT encrypted with the artist's unforgeable signature and uniquely identified on the blockchain," according to Christie's. (The identity of the buyer is not noted on the website.)

Bulletin Board

Curiosities

MAR. 19, 2021

This is the auction house's first sale of purely digital art and the first time it has accepted payment in the form of cryptocurrency, The New York Times reported. Per the sales contract, Winkelmann will earn 10% of the profits each time the work is resold.

"When you buy the artwork, you're sort of entering into a relationship with me," Winkelmann told the Times.

The image file is made up of about 320 megabytes, according to Christie's. Winkelmann drew the early works included in the collage using pen and paper, but he soon switched to a computer software called Cinema 4D, the Times reported. Drawings from the last five years have mostly centered around current events, whereas earlier works included both basic sketches, showing subjects like faces and animals, and conceptual abstract art, exploring themes of color, form and repetition.

"I almost look at it now like I'm a political cartoonist," Winkelmann told Christie's. "Except instead of doing sketches, I'm using the most advanced 3D tools to make comments on current events, almost in real-time." PLAY SOUND

Originally published on Live Science.

livescience.com, 12 March 2021

<https://www.livescience.com>

An experimental toothpaste aims to treat peanut allergy

2021-03-10

Someday it may be possible for people to tackle their food allergies simply by brushing their teeth. A New York City-based company has launched a trial to start testing this concept in a small group of peanut-allergy sufferers. The idea is to expose users to small doses of an allergen daily, in order to build and maintain tolerance to it.

Tying this treatment to a daily routine should help allergy sufferers keep up with regular treatment, say researchers at Intrimmune Therapeutics, which developed the toothpaste. The product may also do a better job than existing therapies at delivering the active ingredients in those treatments to immune cells throughout the mouth, they say.

About 32 million Americans have food allergies. One existing treatment, oral immunotherapy, also exposes patients to small amounts of their

About 32 million Americans have food allergies.

Bulletin Board

Curiosities

MAR. 19, 2021

allergen through daily doses swallowed as food. However, the treatment can trigger allergic reactions, and the hard-earned tolerance often wanes without continued maintenance dosing.

A gentler treatment, known as sublingual immunotherapy — which instead delivers smaller doses through under-the-tongue liquid drops — offers decent protection while causing fewer side effects (SN: 9/4/19). And it may be especially effective with allergies that are caught early. The mouth drops produce even stronger, more durable benefits in toddlers than in older children, researchers reported February 27 at a virtual meeting of the American Academy of Allergy, Asthma & Immunology.

Still, it can be hard for patients to keep up with this daily therapy. Plus, the immune cells thought to be the best target are actually densest inside the cheeks and elsewhere in the mouth — not just under the tongue.

Several years ago, William Reisacher, an allergist at Weill Cornell Medicine in New York City, was puzzling over these concepts while standing in front of a mirror brushing his teeth. “I saw all the foam in my mouth going into all the areas I wanted it to go,” he says. If food proteins could be delivered as a toothpaste, that would get the treatment to the right cells and embed it in a routine daily habit, he thought.

“Bill told me this crazy idea he had, and I thought it was genius,” says Michael Nelson, an attorney trained in biology and health care. Nelson cofounded Intromune to develop the product. The newly launched clinical trial of the toothpaste designed to treat peanut allergy will enroll 32 peanut-allergic adults to test how well they tolerate escalating doses. Future trials may test toothpastes that contain several allergens, Nelson says.

Other allergists support the toothpaste concept, though some worry about dose control and safety. When a patient’s gums are sore and inflamed — for example, after dental work or losing a tooth — allergens may have direct access to the bloodstream, which increases the risk of systemic allergic reactions, says allergist Sakina Bajowala. She offers oral and sublingual immunotherapies for food and environmental allergies at Kaneland Allergy & Asthma Center in North Aurora, Ill. “Safety is something I’m going to be watching closely,” she says. But “if they found something

Bulletin Board

Curiosities

MAR. 19, 2021

they think they can commercialize and make accessible, and if they can prove it’s safe and effective, then fantastic.”

sciencenews.org, 10 March 2021

<https://www.sciencenews.org>

Scientists find a natural protein that stops allergies and autoimmune conditions

2021-03-11

For the millions of us plagued by hypersensitive, overactive, or downright abusive immune systems, it can feel like you’re constantly fighting your own physical self.

From incessant allergies to life-threatening anaphylaxis and debilitating autoimmune disease, the system that’s supposed to be protecting us can be problematic when it goes wrong. Now, we might be closer to fixing these issues in an entirely new way.

Using transgenic mice and cultures of cells taken from human tonsils, researchers have now found evidence of how our bodies might defend against the mistakes that result in conditions such as asthma, food allergies, and lupus. They found a protein called neuritin, produced by immune cells. It acts a bit like an inbuilt, boss-level antihistamine.

“There are over 80 autoimmune diseases, in many of them we find antibodies that bind to our own tissues and attack us instead of targeting pathogens - viruses and bacteria,” explained immunologist Paula Gonzalez-Figueroa from the Australian National University (ANU).

“We found neuritin suppresses formation of rogue plasma cells which are the cells that produce harmful antibodies.”

We have known for some time that the immune system’s regulatory T cells suppress self-targeting antibodies and immunoglobulin E (IgE) - the antibodies that instigate release of the notorious histamines in response to allergies - but not how. It took Gonzalez-Figueroa and her team five years to work it out, with the help of genetically engineered mice and lab-grown human cells.

In another of biology’s usual games of chain reactions, a special class of cells called follicular regulatory T (or Tfr) pumps out neuritin, which turns down production of IgE (this is its antihistamine action) and suppresses

“We found neuritin suppresses formation of rogue plasma cells which are the cells that produce harmful antibodies.”

Bulletin Board

Curiosities

MAR. 19, 2021

other processes that send plasma cells out on self-targeting missions (hence, quashing our autoimmune responses), the researchers found.

Mice without the ability to produce neuritin had an increased chance of dying from anaphylaxis when injected with albumin from an egg. These mice, genetically bred to lack neuritin-producing Tfr cells, grew a population of faulty plasma cells early on in their life. These are the cells that developed self-antigens.

But when the team treated Tfr-deficient mice by injecting neuritin into their veins, they had some striking results.

"Tfr-deficient mice treated with neuritin appeared healthy," Gonzalez-Figueroa and colleagues wrote in their paper, explaining the treatment led to the disappearance of the rogue B cell population too.

The team cautions they're yet to understand the full pathway involved in these immune mechanisms, or the effects of neuritin on other cellular processes. While neuritin has been studied in human nervous systems for quite some time, the exact way it triggers cells hasn't been clear.

To find out, white cells from human blood and tonsils were analysed in the presence of the protein, revealing clues on it acting internally. The results could lead to a better understanding of how we might use neuritin in the future to treat immune conditions.

"This could be more than a new drug - it could be a completely new approach to treat allergies and autoimmune diseases," Vinuesa said.

"If this approach was successful, we would not need to deplete important immune cells nor dampen the entire immune system; instead, we would only need to use the proteins our own body uses to ensure immune tolerance."

If they're right, and neuritin proves safe, it may one day allow the growing number of us facing allergies and autoimmune diseases some peace with our own bodies. Watch this space.

This paper was published in Cell.

sciencealert.com, 11 March 2021

<https://www.sciencealert.com>

Bulletin Board

Curiosities

MAR. 19, 2021

Your brain warps your memories so you can remember them better

2021-03-11

Like a fisherman talking about the size of the one that got away, the brain exaggerates its memories.

This exaggeration is in the service of good, however. New research finds that when people exaggerate the differences between similar memories, they recall them better. The findings could help explain why memory works, and why it often declines with age.

The research involved asking people to match faces to objects, which often differed only slightly in color. When people mentally exaggerated the color differences between the objects, they were better at recalling which face went with which object. Brain imaging showed that this exaggeration was tied to activity in a region of the brain called the lateral parietal cortex.

"It's very fascinating to me to see that memory distortions can actually help us to tell these similar memories apart," said Yufei Zhao, the lead author of the study and a doctoral student in psychology at the University of Oregon. **PLAY SOUND**

Making memories

Zhao and her colleagues had previously conducted research on the hippocampus, a curved region deep in the brain that sits above the brainstem and is important for initially encoding memories. Brain imaging studies had shown some differences in how the hippocampus handled memories of two very similar events, but it wasn't clear whether there were any changes to the content of the memory itself.

In the new study, published in the Journal of Neuroscience on Feb. 22, Zhao and her co-authors focused on a part of the brain that doesn't encode memories but rather helps to recall them: the lateral parietal cortex, which sits beneath the top back of the skull.

"Parietal cortex is actually the place where the memory is housed when we retrieve our memory," Zhao told Live Science. "You will hold your memory in your parietal cortex, so investigating the parietal cortex can give us a very nice window to look at the details of our memory."

There were 29 participants in the study. On day one of the study, the participants were shown 24 different faces, each associated with a

Brain imaging showed that this exaggeration was tied to activity in a region of the brain called the lateral parietal cortex.

Bulletin Board

Curiosities

MAR. 19, 2021

different everyday object, such as a beanbag, hat, balloon or umbrella. Unbeknownst to the participants, the researchers had chosen the objects so that they could later be paired up in a recall test. In half of the cases, these pairs were made up of two different objects — a balloon and a hat, perhaps — that were subtly different in color, just 24 degrees apart on a color wheel. In the other half of cases, the pairs were made up of the same objects — two beanbags — only different because their shades were also 24 degrees apart on the color wheel. One might be light green and the other darker green, for example.

Exaggerated differences

Two beanbags of slightly different color shades should be harder for the brain to remember than a balloon and a hat in those same shades, the researchers reasoned. Thus, if the brain distorts memories to remember them better, the participants should have exaggerated the gap between the colors of same-object pairs more than the gap between the colors of different-object pairs.

On day two of the study, the participants tested their recall. They were shown a picture of a face and the object associated with that face in grayscale. They then had to pick the color of the object on a color wheel. Sure enough, the participants exaggerated the gap in colors in the same-image condition but did not do so in the different-image condition.

This exaggeration was also associated with accuracy, the researchers found. The participants were better at remembering which face went with the correctly colored object when they exaggerated the color differences between the same-object pairs.

Then, the study authors tracked brain activity using functional magnetic resonance imaging (fMRI), which detects changes in oxygenation correlated with blood flow within the brain. Areas with more blood flow are more active. The researchers found differences in the patterns of activation in a wrinkle in the parietal cortex called the ventral intraparietal sulcus. These differences were focused in a region that encodes information about shape and color, and were more pronounced when the participants were recalling same-object pairs versus different-object pairs, meaning that the differences correlated with the exaggerations in the color gaps in people's memories.

"The neural pattern actually remembers them as less similar to each other, Zhao said. That dissimilarity is then correlated with better memory performance, she added.

Bulletin Board

Curiosities

MAR. 19, 2021

Similar memories interfere with each other, becoming difficult to recall clearly (for example, it's easier to remember the one time you parked your car at Disneyland than one of the hundreds of times you parked at your office parking garage). The finding explains one way the brain reduces interference between similar memories, she said. Most likely, she said, this interference reduction starts in the hippocampus, where the brain may initially weigh the differences between two memories heavily in order to differentiate them. For example, if you went to the beach on two different days but one day was windy and the other was calm, the hippocampus might make special note of the weather difference when encoding the memory. Then, when you recall the memory, the parietal cortex may exaggerate the windiness of one day and the stillness of the other so that you retrieve the right day.

The participants in the study were all young, healthy adults with good memory recall, Zhao said — they were 98.9% accurate at recalling face-object matches when the objects were different and 93.2% accurate at remembering the matches when the objects were the same. The next step, she said, is to study older adults. Memory performance declines with age, Zhao said, and one reason might be that the brain becomes less skilled at reducing interference between memories. The researchers now want to find out if the brains of older adults fail to exaggerate the differences between their similar memories.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 11 March 2021

<https://www.livescience.com>

Something is killing California's songbirds

2021-03-11

Songbirds are dying across parts of California and the Pacific Northwest, and officials think crowds at bird feeders are to blame, according to recent news reports.

The California Department of Fish and Wildlife (CDFW) and wildlife rehabilitation centers have been "inundated" with calls since December 2020 from California residents reporting that they found sick or dead finches at their bird feeders, according to a statement posted Feb. 8.

An investigation into the deaths revealed that the birds were infected by the Salmonella bacteria and had developed salmonellosis. A tale as old as (pandemic) time: large gatherings were to blame.

A tale as old as (pandemic) time: large gatherings were to blame.

Bulletin Board

Curiosities

MAR. 19, 2021

Finches who came into contact with food, water or objects contaminated with feces from infected birds can contract the illness, according to the statement. As more birds gather in an area such as a bird feeder or a bird bath, the risk of infection increases.

Most birds die within a day of being infected, Krysta Rogers, an avian disease specialist with the CDFW, said in the statement. Almost all of this year's outbreak were reported in places with bird feeders.

The outbreak especially affected pine siskins (*Spinus pinus*), a species of finch that's small, brown with a sliver of yellow, streaked and very chatty (Its calls sound like a "like a zipper being zipped," according to ebird.org.) But lesser goldfinches (*Spinus psaltria*), American goldfinches (*Spinus tristis*) and others were also affected. Most of these salmonellosis cases were along the Central Coast, in the San Francisco Bay Area and in the Sierra Nevada.

Infected birds look lethargic, puffed or fluffed up with partially closed eyes (and sometimes with swollen, red or irritated eyes), according to Sonoma County's Bird Rescue Center.

"Salmonellosis occurs periodically in pine siskins in some winters throughout their range," Rogers said in the statement. However, this year's outbreak is particularly bad because it's an "irruption year" of pine siskins. There's a lot of pine siskins that have traveled south due to a shortage of seeds in Canada, according to the Bird Rescue Center of California's Sonoma County and The National Audubon Society.

Because pine siskins can spread the bacteria, salmonellosis outbreaks are often correlated with irruption years, according to the Bird Rescue Center. If you find a sick or dead bird, officials recommend contacting your local wildlife rescue center immediately. They also recommend keeping young children or free-roaming cats and dogs away from infected equipment or dropped seeds.

But "the very best way" to stop the birds from spreading the bacteria is to remove the bird baths and feeders so that the birds can spread out and feed on natural vegetation, according to The Bird Rescue Center. The Center "strongly recommends" removing the feeders and birdbaths from your yard until next spring when the Pine Siskins migrate north once again.

But the outbreak isn't solely contained to California, dead and sick birds are also turning up in the Pacific Northwest. The Washington state

Bulletin Board

Curiosities

MAR. 19, 2021

Department of Fish and Wildlife has also urged people to take down their bird feeders until at least April 1.

Editor's Note: This story was updated to include that the outbreak is also happening in the Pacific Northwest.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 11 March 2021

<https://www.livescience.com>

Scientists create self-replicating chemicals to help explain the origins of life

2021-03-11

One of the most enduring questions in science is how life on Earth began. After all, Earth started out as nothing more than a big vat of dead chemicals. Yet unless DNA came from another planet, these non-biological elements somehow coalesced into life. Some scientists are trying to figure out how this happened, while others are taking inspiration from it and trying to create something life-like themselves.

A few years ago, chemists at Harvard University made some intriguing progress. By mixing together some water and a few basic chemicals, and then hitting them with light and oxygen, they could see little cell-like compartments grow up and die, only to be reborn once again. In these objects, which the researchers called "phoenix" structures, there seemed to be a primitive, life-like process taking place, a remarkable occurrence for what was really no more than a polluted puddle. In a new paper published in late February in the *Nature journal Communications Chemistry*, researchers Chenyu Lin, Sai Krishna Katla, and Juan Pérez-Mercader have managed to explain their earlier observed phenomenon of self-replication. This understanding should enable the design of even more life-like chemical systems. Ultimately, they aim to do something like nature did when she first originated life on planet Earth.

Clusters of molecules, gathering around in the vast waters of the early planet, somehow began to evolve. Nobody yet knows how it happened, but there were plentiful characters around to inject drama into life's early stage. There were fiery volcanoes that exploded with carbon dioxide, hydrothermal vents emitting rich brews of chemicals, and other diverse sources of energy and molecular matter.

Clusters of molecules, gathering around in the vast waters of the early planet, somehow began to evolve.

Bulletin Board

Curiosities

MAR. 19, 2021

In Pérez-Mercader's experiments, the chemicals are man-made in origin. "The ones we use in the experiments are not seen anywhere in nature, *per se*," he said in an interview. For that reason, the chemical plays that the researchers enact speak less to the origins of life on Earth, and more to the remarkable powers of laboratory chemistry.

Nevertheless, there are tantalizing similarities with their experiments to how scientists think life may have originated on Earth. Starting with a watery chemical soup, they place their solution under the eye of a microscope, where a light shines down like the sun. They also add in bubbles of oxygen, which send chemical reactions coursing through the molecular mixture.

The lead players that traverse through all of this are tiny organized structures called micelles. Roughly speaking, a micelle looks a little bit like a meatball covered in spiky hair. Each of the hairs have the same length, thanks to the use of a clever chemical production process called RAFT ("reversible addition fragmentation chain transfer"). In reality, both the meat and the hairs are unique chains of molecules known as polymers.

In the early 2000s, researchers figured out how to get these structures to assemble themselves out of scratch, in a process called polymerization induced self assembly, or PISA. This process introduces microscopic structure into what is initially just a soup of randomly distributed molecules. "It can make spheres and very nice shapes," said Pérez-Mercader.

In earlier experiments, the researchers had watched these micelles grow, the meatballs filling with water; the micelles would turn into vesicles. Eventually, they would implode, only to reform once again. They deemed these life-approximating things "phoenix" structures, in analogy to the regenerating birds of Greek mythology.

In their new experiments, the researchers noticed that the deaths of the phoenixes are actually essential to their reproduction. Each time a phoenix implodes, it distributes a rich bath of raw materials that allow new phoenixes to form. This process crudely mimics the reproductive process of life, which causes biological cells to divide and replicate in response to their death and decay.

The researchers pinpointed that it is the oxygen that causes the micelles to degrade to new raw materials. Oxygen is widely known to be a pesky, reactive molecule that can damage life-like structures. In this case, oxygen

Bulletin Board

Curiosities

MAR. 19, 2021

molecules react with the interior molecules of the micelle (the meaty parts), breaking them down.

The combination of light and oxygen causes even more breakdown, and the interiors of the vesicles become filled with a concentrated brew of breakdown products. Water then gets drawn in from outside by osmosis, making the vesicles surge with growth.

Eventually, a vesicle's outer membrane implodes from the pressure. This distributes a rich bath of raw materials around the old vesicle, seeding the growth of many new micelles. Without the degrading presence of oxygen, the researchers observed that the entire solution would simply turn into a gel.

The membrane proves to be just as important, however, as the oxygen. The oxygen enables the breakdown of the micelle into raw materials, but the membrane traps them inside. Without a membrane to hold them together, they would be thinly distributed throughout the entire solution. More and more micelles would form, but there would be no self-replication of vesicles.

The membranes address a fundamental problem faced by scientists who study the origins of life, called the "arithmetic demon." The problem is that life consists of extremely specialized biomolecules, like DNA and RNA, which had to somehow be formed from much simpler molecules.

Scientists know how to form them, but it requires a lengthy, step by step process called organic synthesis. And at the end of each step, fewer and fewer of the desired intermediary chemicals are produced. At the end of the overall process, few biomolecules are produced compared to the amount of the starting ingredients.

In the lab, scientists get around the problem by carefully concentrating the outputs of every step. But in the Earth's early environment, like an ocean or lake, there would be no obvious way to concentrate the yields from each step. They would thin out too much before they could produce biomolecules. "The arithmetic works against you," said Pérez-Mercader. "You need to beat the demon."

The results show that beating the demon is indeed possible with the artificial membranes generated by PISA. These membranes concentrate the breakdown products inside of them, enabling the phoenixes to reproduce.

Bulletin Board

Curiosities

MAR. 19, 2021

Actual life, however, does more than just reproduce. As the authors state in their introduction, it also processes information, metabolizes food, and evolves. Once the authors can combine all these properties, then their artificially created systems will go head to head with life's best.

vice.com, 11 March 2021

<https://www.vice.com>

What fueled humans' big brains? Controversial paper proposes new hypothesis

2021-03-13

Over the course of the Pleistocene epoch, between 2.6 million years ago and 11,700 years ago, the brains of humans and their relatives grew. Now, scientists from Tel Aviv University have a new hypothesis as to why: As the largest animals on the landscape disappeared, the scientists propose, human brains had to grow to enable the hunting of smaller, swifter prey.

This hypothesis argues that early humans specialized in taking down the largest animals, such as elephants, which would have provided ample fatty meals. When these animals' numbers declined, humans with bigger brains, who presumably had more brainpower, were better at adapting and capturing smaller prey, which led to better survival for the brainiacs.

Ultimately, adult human brains expanded from an average of 40 cubic inches (650 cubic centimeters) at 2 million years ago to about 92 cubic inches (1,500 cubic cm) on the cusp of the agricultural revolution about 10,000 years ago. The hypothesis also explains why brain size shrank slightly, to about 80 cubic inches (1,300 cubic cm), after farming began: The extra tissue was no longer needed to maximize hunting success.

This new hypothesis bucks a trend in human origins studies. Many scholars in the field now argue that human brains grew in response to a lot of little pressures, rather than one big one. But Tel Aviv University archaeologists Miki Ben-Dor and Ran Barkai argue that one major change in the environment would provide a better explanation.

"We see the decline in prey size as a unifying explanation not only to brain expansion, but to many other transformations in human biology and culture, and we claim it provides a good incentive for these changes," Barkai wrote in an email to Live Science. "[Scholars of human origins] are not used to looking for a single explanation that will cover a diversity of adaptations. It is time, we believe, to think otherwise."

Bulletin Board

Curiosities

MAR. 19, 2021

Big prey, growing brains

The growth of the human brain is evolutionarily outstanding, because the brain is a costly organ. The Homo sapiens brain uses 20% of the body's oxygen at rest despite making up only 2% of the body's weight. An average human brain today weighs 2.98 lbs. (1,352 grams), far exceeding the brains of chimpanzees, our nearest living relatives, at 0.85 lb. (384 grams).

Barkai and Ben-Dor's hypothesis hinges on the notion that human ancestors, starting with Homo habilis and peaking with Homo erectus, spent the early Pleistocene as expert carnivores, taking down the biggest, slowest prey that Africa had to offer. Megaherbivores, the researchers argue in a paper published March 5 in the journal Yearbook of Physical Anthropology, would have provided ample calories and nutrients with less effort than foraging plants or stalking smaller prey. Modern humans are better at digesting fat than other primates are, Barkai and Ben-Dor said, and humans' physiology, including stomach acidity and gut design, indicate adaptations for eating fatty meat.

In another paper, published Feb. 19 in the journal Quaternary, the researchers argue that human species' tools and lifestyle are consistent with a shift from large prey to small prey. In Barkai's fieldwork in Africa, for example, he has found Homo erectus sites strewn with elephant bones, which disappear at later sites from between 200,000 and 400,000 years ago. The human ancestors at those more recent sites seemed to have been eating mostly fallow deer, Ben-Dor wrote in an email to Live Science.

Overall, megaherbivores weighing over 2,200 lbs. (1,000 kilograms) began to decline across Africa around 4.6 million years ago, with herbivores over 770 lbs. (350 kg) declining around 1 million years ago, the researchers wrote in their paper. It's not clear what caused this decline, but it could have been climate change, human hunting or a combination of the two. As the biggest, slowest, fattiest animals disappeared from the landscape, humans would have been forced to adapt by switching to smaller animals. This switch, the researchers argue, would have put evolutionary pressure on human brains to grow larger because hunting small animals would have been more complicated, given that smaller prey is harder to track and catch.

These growing brains would then explain many of the behavioral changes across the Pleistocene. Hunters of small, fleet prey may have needed to develop language and complex social structures to successfully communicate the location of prey and coordinate tracking it. Better

Bulletin Board

Curiosities

MAR. 19, 2021

control of fire would have allowed human ancestors to extract as many calories as possible from smaller animals, including grease and oil from their bones. Tool and weapon technology would have had to advance to allow hunters to bring down and dress small game, according to Barkai and Ben-Dor. [PLAY SOUND](#)

A fuzzy past

Single hypotheses for human brain evolution haven't held up well in the past, however, said Richard Potts, a paleoanthropologist and head of the Smithsonian's Human Origins Program in Washington, D.C., location, who wasn't involved in the research. And there are debates about many of the arguments in the new hypothesis. For example, Potts told Live Science, it's not clear whether early humans hunted megaherbivores at all. There are human cut marks on large-mammal bones at some sites, but no one knows whether the humans killed the animals or scavenged them.

The researchers also sometimes use arguments from one time period that might not apply to earlier times and places, Potts said. For example, the evidence suggests a preference for large prey by Neanderthals living in Europe 400,000 years ago, which would have served those human relatives well in winter, when plants were scarce. But the same thing might not have held true a few hundred thousand or a million years earlier in tropical Africa, Potts said.

And when it comes to brains, size isn't everything. Complicating the picture, brain shape also evolved over the Pleistocene, and some human relatives — such as *Homo floresiensis*, which lived in what is now Indonesia between 60,000 and 100,000 years ago — had small brains. *H. floresiensis* hunted both small elephants and large rodents despite its small brain.

The period over which humans and their relatives experienced this brain expansion is poorly understood, with few fossil records to go on. For example, there are perhaps three or four sites firmly dated to between 300,000 and 400,000 years ago in Africa that are certainly related to humans and their ancestors, said John Hawks, a paleoanthropologist at the University of Wisconsin–Madison who was not involved in the research and was skeptical of its conclusions. The human family tree was complicated over the course of the Pleistocene, with many branches, and the growth in brain size wasn't linear. Nor were the declines in large animals, Hawks told Live Science.

Bulletin Board

Curiosities

MAR. 19, 2021

"They've sketched out a picture in which the megaherbivores decline and the brains increase, and if you look at that through a telescope, it sort of looks true," Hawks told Live Science. "But actually, if you look at the details on either side, brain size was more complicated, megaherbivores were more complicated and it's not like we can draw a straightforward relationship between them."

The paper does, however, draw attention to the fact that human species may indeed have hunted large mammals during the Pleistocene, Hawks said. There is a natural bias in fossil sites against preserving large mammals, because human hunters or scavengers wouldn't have dragged an entire elephant back to camp; they would have sliced off packets of meat instead, leaving no evidence of the feast at their home sites for future paleontologists and archaeologists.

"I'm sure we're going to be talking more and more about what was the role of megaherbivores in human subsistence, and were they important to us becoming human?" Hawks said.

Originally published on Live Science.

livescience.com, 13 March 2021

<https://www.livescience.com>

Bulletin Board

Technical Notes

MAR. 19, 2021

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

CHEMICAL EFFECTS

[The selective toxicity of superparamagnetic iron oxide nanoparticles \(SPIONs\) on oral squamous cell carcinoma \(OSCC\) by targeting their mitochondria](#)

[Synthetic organic chemicals \(flame retardants and pesticides\) with neurotoxic potential induced behavioral impairment on zebrafish \(Danio rerio\): a non-invasive approach for neurotoxicology](#)

[Organophosphate Flame Retardants, Highly Fluorinated Chemicals, and Biomarkers of Placental Development and Disease during Mid-Gestation](#)

ENVIRONMENTAL RESEARCH

[Prediction of organic compounds adsorbed by polyethylene and chlorinated polyethylene microplastics in freshwater using QSAR](#)

[Estimating climate change-related impacts on outdoor air pollution infiltration](#)

OCCUPATIONAL

[Effects of long-term high-level lead exposure on the immune function of workers](#)

[Methyl siloxanes in soils from a large silicone-manufacturing site, China: concentrations, distributions and potential human exposure](#)

[Epidemiological Study of Mortality Among Workers Exposed to Tritium in France](#)

[Assessment of respiratory exposure to cypermethrin among farmers and farm workers of Shiraz, Iran](#)

PHARMACEUTICAL/TOXICOLOGY

[Pentachlorophenol and nine other chlorophenols in urine of children and adolescents in Germany - Human biomonitoring results of the German Environmental Survey 2014-2017 \(GerES V\)](#)