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

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ASIA PACIFIC

Comparative performance monitoring report 22nd edition

2021-01-29

The Comparative Performance Monitoring report analyses trends in WHS and workers' compensation scheme performance across Australia and New Zealand.

The report facilitates the improvement of WHS, workers' compensation and related service outcomes in Australia and New Zealand by:

monitoring the comparative performance of jurisdictions over time, and enabling benchmarking across jurisdictions and identifying best practice to support policy making.

The 22nd edition has three parts:

Part 1 covers WHS performance. It compares serious claim rates and work-related fatalities across jurisdictions.

Part 2 covers WHS compliance and enforcement activities.

Part 3 covers premiums, entitlements and scheme performance.

Related materials

Comparative performance monitoring reports

[Read More](#)

Safe Work Australia, 29 January 2021

<https://www.safeworkaustralia.gov.au/collection/comparative-performance-monitoring-reports>

Get ready for GHS 7

2021-01-29

On 1 January 2021, Australia began a two-year transition from the Globally Harmonized System of Classification and Labelling of Chemicals Revision 3 (GHS 3) to Revision 7 (GHS 7).

The GHS is a global method of classifying chemicals and preparing labels and safety data sheets.

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Businesses that manufacture, import, supply or use hazardous chemicals should watch the online presentation.

Topics covered include:

what the GHS is, why it is changing, and what it will mean for businesses

transition arrangements

what is changing, including changes to classification and labelling requirements

Watch the Transition to GHS 7 webinar.

For more guidance material and resources for businesses, go to the GHS 7 transition web page.

[Read More](#)

Safe Work Australia, 29 January 2021

<https://www.safeworkaustralia.gov.au/media-centre/news/get-ready-ghs-7>

Categorisation of biochemicals

2021-01-29

Extra information to help you categorise the importation and manufacture (introduction) of biochemicals.

Have you checked if your chemical is on our Inventory? If your chemical is on our Inventory and your introduction meets the terms of Inventory listing, your introduction is automatically categorised as a 'listed' introduction. [Read about listed introductions.](#)

Who should read this?

Importers and manufacturers (introducers) of industrial chemicals (and products that release industrial chemicals) who are working out if the importation/manufacture (introduction) of their biochemical will be an exempted, reported or assessed introduction. This information should be read before the chemical is introduced in Australia. You must read this in conjunction with our [categorisation guide](#).

What is a biochemical?

This information should be read before the chemical is introduced in Australia.

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We define the term 'biochemical' in a way that might be different from usual definitions. Check our definitions carefully to make sure that your chemical is a biochemical according to our definition.

A **biochemical** is a biological chemical that:

is directly produced by a microscopic organism, or

is a protein or a nucleic acid.

A **biological chemical** is a chemical that is derived from, or produced by, a living or once-living organism.

An **organism** is a biological entity that is:

viable or

capable of reproduction or

capable of transferring genetic material.

In other words, a biochemical is a chemical directly produced by microorganisms such as bacteria, algae, fungi, protozoa or viruses. An example of a biochemical is the enzyme subtilisin that is produced by *Bacillus subtilis*.

A biochemical can also be a protein or nucleic acid, such as keratin and collagen.

A **biopolymer** is a type of a biochemical – one that also meets our definition of a polymer. [Read about categorisation of polymers.](#)

Your Introduction is a 'specified class of introduction' if it is a biochemical.

We have an increased level of concern for specified classes of introductions due to a greater potential for particular hazards or high levels of human or environmental exposure. For this reason, there may be additional or different requirements when working out your category of introduction as well as additional record keeping obligations.

Our increased level of concern for introductions of biochemicals is because of the organisms used to produce the biochemical. Small amounts of these production organisms might be present with the biochemical after it is produced and these organisms might remain viable. These could potentially cause adverse effects to humans or the environment. The additional or different requirements arising from these concerns are outlined below.

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Is your introduction exempted, reported or assessed?

You must work out if your introduction meets the criteria for the exempted or reported categories by going through steps 1-6 of the [categorisation guide](#). If your introduction does **not** meet the criteria for the exempted or reported categories, it will be an assessed introduction (unless you meet the criteria for a [commercial evaluation authorisation](#)).

There are no additional or different requirements to be aware of when working out your category of introduction, due to your chemical being a biochemical.

If your introduction is categorised as assessed, when submitting your application for an assessment certificate, you need to:

identify that your introduction is a specified class of introduction

provide any additional information that is required based on your chemical being a biochemical. If your introduction is categorised as reported, when submitting your pre-introduction report, you need to identify that your introduction is a specified class of introduction and select that "it is a biochemical".

If your introduction is categorised as exempted, because you worked out that the highest indicative risk for your introduction is very low risk, you need to keep a record that your introduction is a specified class of introduction, i.e. that "it is a biochemical".

Additional record keeping obligations for exempted and reported introductions

If your introduction is of a biochemical, and

you worked out your introduction category as exempted or reported by following steps 4-6 of our categorisation steps, and

your introduction is not internationally-assessed for human health and the environment, or

your introduction is internationally assessed for the environment but **not** human health

then, you must keep the following records:

the concentration of any remaining viable cell or cellular components of the organisms used to produce the biochemical

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information on any known adverse effects of any remaining viable cell or cellular components of the organisms used to produce the biochemical.

For all other record keeping requirements that apply to your chemical introduction see our guidance on [reporting and record keeping obligations](#).

[Read More](#)

AICIS Industrial Chemicals Regulatory News, 29 January 2021

<https://www.industrialchemicals.gov.au/help-and-guides/extra-resources-help-you-categorise-your-introduction/categorisation-biochemicals>

AMERICA

Navigating the transition: Key chemicals industry issues to watch in the Biden administration

2021-01-28

While news stories and campaign rhetoric can frequently create expectations of immediate shifts after a change in administration, most changes happen slowly in the federal government, and constraints on resources means that many areas of environmental regulation and permitting policy will remain unchanged in the early years of the new administration.

EPA's Risk Management Program ("RMP") Regulation

RMP regulations govern safety protocols in industries using hazardous chemicals. In November 2019, the Trump administration rescinded many of the significant Obama-era amendments to the RMP, which many in the industry believed to be overly burdensome and costly. The removed provisions included requirements regarding third-party audits, incident investigation root cause analysis, and safer technology and alternatives analyses. The Trump administration's amendments were intended to shift from rules that increase compliance costs for the entire regulated community to case-specific oversight of poorly performing facilities. The Trump administration's RMP Rule changes are currently facing legal challenges in the D.C. Circuit. In December 2020, the D.C. Circuit granted an unopposed motion to stay this litigation until March 22, 2021, which was requested in part to allow the incoming Biden administration time to review the 2019 RMP Rule and consider its position. Courts regularly allow new administrations some limited time to undertake such reviews.

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However, it is unlikely that a Biden EPA would simply stop defending the rule in its existing form, or that the court would allow it to alter the rule's current requirements without following the time-consuming process for revising a regulation.

The Biden administration has made environmental justice a focus of its environmental platform. Environmental justice is defined by EPA as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." It is likely that the Biden administration will revert to the Obama EPA model of RMP regulation as part of its environmental justice initiative, including third-party audits and incident investigation root cause analysis. Indeed, the administration indicated in a fact sheet released on January 20, 2021 that this rule is on its list of agency actions to review. Because the Trump administration's RMP Rule revisions already have gone into effect, it will take the Biden administration time to complete the administrative rulemaking process necessary to implement a more robust RMP Rule, and the final rule will then be subject to challenge in court. As a result, it is unlikely that there will be changes to the RMP Rule in the first year of the new administration. However, as discussed further below, the *enforcement* of the existing RMP Rule may change under the new administration.

Environmental Enforcement in the Chemical Manufacturing Sector

For years, EPA has focused its enforcement efforts on emissions of ozone precursors and hazardous air pollutants from the chemical manufacturing sector. These efforts generally related to enforcement of leak detection and repair requirements, flare performance requirements, tank emission limitations, wastewater treatment system requirements (e.g., the benzene waste operations NESHAP and VOC emission limitations), and to a lesser extent, enforcement of MACT and NSPS emission limitations. We would expect these enforcement efforts to continue, with the following potential changes in emphasis.

Environmental justice. The effects of noncompliance on environmental justice communities has for many years been a part of the EPA's case evaluation and enforcement processes. We expect a Biden EPA to emphasize environmental justice in enforcement by leaning in more aggressively when known noncompliance is affecting an environmental justice community, increasing its use of the EJSCREEN screening and mapping tool as an enforcement targeting method, and increasing

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its release reporting and risk management enforcement in areas with environmental justice communities.

Beyond compliance settlements. We expect a return to the Obama EPA's use of extra-regulatory requirements in settlements. These could include using elements of so-called Next Generation compliance developed by the Obama EPA, and importing regulatory requirements from other federal agencies (e.g., using PHMSA requirements in pipeline spill cases) and other EPA programs (e.g., using refinery flaring regulations to reduce flaring emissions in petrochemical facility settlements).

Storage tank and wastewater treatment systems. We expect a Biden EPA to be less solicitous of state enforcement solutions to excess emissions from storage tanks and water treatment systems at petrochemical production and storage facilities. An EPA-centric enforcement approach might not achieve significantly greater reductions in VOCs from these operations, but it could result in a higher number of EPA cases and increased costs to the chemical sector, particularly if extra-regulatory requirements are included in settlements.

Section 112(r) risk management program. The Trump EPA focused on RMP cases where a company violated a plain industry standard, particularly where industrial accidents affected workers or communities. We would expect a Biden EPA to broaden somewhat the kinds of RMP cases it will be willing to bring, including cases where the applicability of an industry standard is not clear.

[Read More](#)

JD Supra, 28 January 2021

<https://www.jdsupra.com/legalnews/navigating-the-transition-key-chemicals-7116620/>

Deadline for filing annual pesticide production reports—March 01 2021

2021-01-27

The March 1, 2021, deadline for all establishments, foreign and domestic, that produce pesticides, devices, or active ingredients to file their annual production for the 2020 reporting year is fast approaching. Pursuant to Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 7(c)(1) (7 U.S.C. § 136e(c)(1)), "Any producer operating an establishment registered [under Section 7] shall inform the Administrator within 30

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days after it is registered of the types and amounts of pesticides and, if applicable, active ingredients used in producing pesticides" and this information "shall be kept current and submitted to the Administrator annually as required."

Reports must be submitted on or before March 1 annually for the prior year's production. The report, filed through the submittal of EPA Form 3540-16: Pesticide Report for Pesticide-Producing and Device-Producing Establishments, must include the name and address of the producing establishment; and pesticide production information, such as product registration number, product name, and amounts produced and distributed. The annual report is always required, even when no products are produced or distributed.

EPA has created the electronic reporting system to submit pesticide-producing establishment reports using the Section Seven Tracking System (SSTS). Users will be able to use SSTS within EPA's Central Data Exchange (CDX) to submit annual pesticide production reports. Electronic reporting is efficient, saves time by making the process faster, and saves money in mailing costs and/or courier delivery and related logistics. EPA is encouraging all reporters to submit electronically to ensure proper submission and a timely review of the report, as the majority of EPA staff are still working remotely and may not be on site to receive mailed reports.

[Read More](#)

B&C Pesticide Blog, 27 January 2021

<https://pesticideblog.lawbc.com/entry/deadline-for-filing-annual-pesticide-production-reports-march-1-2021>

Illinois EPA issues health advisories for per- and polyfluoroalkyl substances (PFAS) in accordance with Illinois groundwater regulations

2021-01-28

SPRINGFIELD – Illinois Environmental Protection Agency Director John J. Kim today announced the issuance of health advisories for four chemicals in accordance with Illinois groundwater regulations. Health advisories are issued when there is detection of a chemical substance(s) harmful to human health for which no numeric groundwater standard(s) exists, and resampling confirms the presence in a community water supply well (35 Ill. Adm. Code 620.605).

The four chemicals specified in the health advisories are compounds included in the family of per- and polyfluoroalkyl substances (PFAS), often referred to as "forever chemicals" because of their persistence over time in surface water and groundwater.

The annual report is always required, even when no products are produced or distributed.

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The four chemicals specified in the health advisories are compounds included in the family of per- and polyfluoroalkyl substances (PFAS), often referred to as “forever chemicals” because of their persistence over time in surface water and groundwater. Each health advisory contains a general description of the chemical, information on carcinogenicity and potential adverse health effects, and a guidance level. The below chart provides the health advisory guidance level for each chemical identified.

Chemical Abstract Services Registry Number (CASRN)	Substance Name	Substance Acronym	HA Guidance Level in milligrams per liter (mg/L)	HA Guidance Level in nanograms per liter (ng/L)
375-73-5		PFBS	0.14	140,000
355-46-4		PFHxS	0.00014	140
307-24-4		PFHxA	0.56	560,000
335-67-1		PFOA	0.000002	2

The health advisories will be published in the Environmental Register, a publication of the Illinois Pollution Control Board, and placed on the website: <https://pcb.illinois.gov/Resources/News>. The health advisories are also available on the Illinois EPA website at: <https://www2.illinois.gov/epa/topics/water-quality/pfas/Pages/pfas-healthadvisory.aspx>

“This action is part of the Illinois EPA’s statewide PFAS investigation intended to determine the prevalence of PFAS chemicals in our community water supplies. This information is critical to future efforts to set drinking water standards for PFAS compounds,” said Director Kim. “Illinois EPA will work with affected community water supplies to ensure measures are taken to protect drinking water.”

The guidance levels contained in the health advisories are not enforceable groundwater or drinking water standards. The Illinois EPA will use the health advisory guidance levels and data gathered from the statewide drinking water investigation in the development of enforceable drinking

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water standards for PFAS known as Maximum Contaminant Levels, or MCLs.

The statewide PFAS investigation, which began in September 2020, is expected to be completed in the fall of 2021. The Illinois EPA is sampling drinking water at every Community Water Supply in Illinois. If PFAS chemicals are confirmed at concentrations above laboratory minimum reporting levels (MRLs), the Illinois EPA will work directly with those community water supplies to ensure residents are informed and to determine next steps for reducing exposure. To date, Illinois EPA has 442 samples from community water supplies in Illinois. An additional 1,012 samples will be collected as the investigation continues. A complete listing of sample results to date is available on the interactive map established by Illinois EPA at: <https://illinois-epa.maps.arcgis.com/apps/opsdashboard/index.html#/d304b513b53941c4bc1be2c2730e75cf>.

For additional information, please visit the Statewide PFAS Investigation Network webpage at:

<http://www2.illinois.gov/epa/topics/water-quality/pfas/Pages/default.aspx>.

Myradiolink, 28 January 2021

<https://www.myradiolink.com/2021/01/28/illinois-epa-issues-health-advisories-for-per-and-polyfluoroalkyl-substances-pfas-in-accordance-with-illinois-groundwater-regulations/#>

EUROPE

Let’s end the debate: outing international shipping into the ETS is clearly legal

2021-01-29

Shipping companies are crying foul over EU plans to regulate the sector’s emissions. But the industry’s claim that new rules would break international law has no legal basis, write Faig Abbasov and Aoife O’Leary.

Faig Abbasov is shipping director with Transport & Environment, a clean mobility campaign group; Aoife O’Leary is director for international climate at the Environmental Defense Fund, a green NGO.

Politics aside, legally speaking, this is an incompetent effort to say the least.

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After thirty years of regulatory silence on international shipping emissions, the EU has now committed to act by extending its Emissions Trading Scheme (ETS) to cover the maritime sector. Not surprisingly, much of the shipping industry is trying to prevent this by stoking trade tensions and raising international legal questions.

Their goal is ostensibly to scare the EU and member states against climate action on shipping. Politics aside, legally speaking, this is an incompetent effort to say the least. Here's why.

The EU is amending its Monitoring, Reporting and Verification Regulation (MRV) for shipping emissions which requires all ships stopping at EU ports to provide information on their emissions. Some of the amendments would require those ships to actually reduce emissions on journeys to or from and within the EU.

The European Parliament has approved the amendments, but is waiting for the European Council to weigh in. Regardless of the outcome of that negotiation, the European Commission has promised to bring forward several proposals this year on reducing shipping's climate impact.

So, while there will be a debate about how the EU is going to regulate international shipping, there is no doubt that it will happen soon.

The shipping industry suggests that putting shipping in the EU ETS might not comply with international law. The same question was raised when aviation was put in the EU ETS with various industry groups challenging the legality of that move. However, the EU Court of Justice, Europe's highest court, ruled that the action did comply with international law.

[Read More](#)

EURACTIV, 29 January 2021

<https://www.euractiv.com/section/shipping/opinion/lets-end-the-debate-putting-international-shipping-into-the-ets-is-clearly-legal/>

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INTERNATIONAL

Poison on a plate: Outdated agrichemical legislation means your avocado-topped pizza could be hazardous to your health

2021-01-26

All South African consumers of commercially farmed products eat food produced with the use of 'crop protection solutions' and 'chemical remedies' exported to Africa from the EU – where they have often been banned. The problem is that South Africa lacks an effective legislative framework to regulate agrochemicals and appointed 'the fox to guard the henhouse'.

In late 2020 a webinar titled [Unpoison Our Legislation](#) brought to light harrowing but little-known facts about the state of chemical use in South Africa and the lack of protection for the public.

In her presentation on the legal framework, Advocate Susannah Cowen, a member of [Thulamela Chambers](#), told the webinar: "There is a clear absence of an effective legislative framework to regulate agrochemicals in South Africa, and this results in consistent and systematic breaches of human rights."

These include the [constitutional rights](#) to life, dignity, an environment that is not harmful to health or well-being, fair labour practices, security and control over one's body, access to information and just administrative action.

Cowen was reporting back on a [legal submission](#), made on behalf of The Real Thing to President Cyril Ramaphosa and eight government ministers shortly before the outbreak of the coronavirus pandemic in March 2020. The submission called for a complete overhaul of the legislation but unfortunately has not been heeded.

The current law, [Act 36 of 1947](#), is three-quarters of a century old and has not been updated, in stark contrast to the ever and rapidly advancing biotech industry and the plethora of associated chemical products in use in South Africa.

The problem is that South Africa lacks an effective legislative framework to regulate agrochemicals and appointed 'the fox to guard the henhouse'.

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REACH Update

FEB. 05, 2021

Not to be sniffed at

2021-01-27

In the wake of REACH, the aerospace aftermarket still needs to get to grips with dust extraction, says Minden Systems' managing director & sales, Les Brooker.

It's hard to believe that the REACH Directive is nearly 13 years old, but there is still work to do to eradicate the exposure of dangerous substances to workers in the aerospace industry.

Born in June 2007, the EU's REACH regulation is a force for good. We all like to bemoan the added burden placed on us by new rules, but it's important to say that the directive is a positive development. It has two key, laudable objectives; to protect people and the planet from harmful chemicals, while enhancing competitiveness of the European chemicals industry.

REACH places the burden of proof on companies. To comply with the regulation, companies must identify and manage the risks linked to the substances they manufacture and market in the EU. They have to demonstrate to the European chemicals agency (ECHA) how the substance can be safely used, and they must communicate the risk management measures to the users.

Obviously, the aerospace industry uses many thousands of chemical substances within the manufacturing process. Inevitably, it takes years to assess and catalogue so many chemicals to meet the regulation. This predicament has led to something known as 'sunset dates' after which the placing on the market (and the use of a substance) is prohibited unless an authorisation is granted. It's a stay of execution for certain chemicals.

Where certain substances such as lead chromate and hexa-chromates are concerned, these chemicals have been granted dispensation from REACH due to their unusually good cohesive and protective properties that are central to the aerospace production process.

The problem which emanates from this ruling is most evident in the aftermarket, where vital maintenance and repairs are undertaken for both civil and military aircraft. Often overlooked, this is a major part of the aerospace sector, comprising around 1,300 companies employing close to 60,000 people according to latest government statistics.

REACH places the burden of proof on companies.

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Read More

Aerospace Manufacturing, 27 Jan 2021

<https://www.aero-mag.com/minden-systems-reach-20012021/>

Brexit: relief rapidly gives way to fresh concerns

2021-01-28

WHILE the UK Government has lauded its eleventh-hour agreement with the EU for a zero-tariff, zero-quota trade deal, businesses and industry groups have warned about a raft of issues that require further negotiation and clarification, and about new, costly administrative burdens that are impacting businesses and remapping supply chains.

On 24 December, in the wake of news that the EU and UK had avoided a no-deal Brexit, there was a wave of relief that importers and exporters would avoid tariffs. Trade group Make UK said a no-deal outcome would have caused catastrophic damage to manufacturing in Britain. The Chemical Industry Association (CIA) estimated it would have hit the sector with an extra £1bn in annual costs.

But relief quickly passed to concern: "Today's vote [to pass the deal] finally ends more than four years of uncertainty and dispute, during which investment has ground to a halt," said Make UK CEO Stephen Phipson. "However, businesses must now manage their way through one of the biggest changes to trade ever seen, which takes effect in just 48 hours. There will be new customs paperwork, arrangements at the border and significant additional red tape."

Phipson said the UK Government must move quickly and work with both UK business and EU partners "to address a wide range of issues such as rules of origin, recognition of professional qualifications and chemical registration systems where the new arrangements are likely to be most challenging".

Fresh cost

New administrative burdens for those trading across the English Channel include completing customs declarations and providing details on supply chains to avoid tariffs under rules of origin obligations. This extra cost of compliance will erode competitiveness for the UK chemicals sector which relies on the EU for 60% of its exports. It is a risk to low-margin chemicals trade and it is already reshaping UK-EU supply chains.

Trade group Make UK said a no-deal outcome would have caused catastrophic damage to manufacturing in Britain.

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REACH Update

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In January, Aston Chemicals, a medium-sized chemicals importer and distributor said it had ceased exporting to the EU from the UK. To avoid extra costs, it has separated its supply chains, using a subsidiary in Poland for its EU distribution while reducing UK warehousing staff, the *Financial Times* reported.

Robinson Brothers, a manufacturer and exporter of fine chemicals and rubber accelerators that employs 300 people in the UK, told *The Chemical Engineer* that the most noticeable impacts since the deal passed are delays at ports and having to complete additional documentation.

"There has been a significant increase in red tape and cost," said Adrian Hanrahan, Managing Director of Robinson Brothers. "This provides zero benefit to our employees, our company, our customers or UK PLC but is a great potential benefit to our competitors in the EU who do not have these same costs."

Hanrahan is thankful that many customers have remained loyal, though he has noticed uncertainty among others, and said some potential business has been lost to EU competitors.

"And I have not talked about the opportunity costs. We could be using the cash tied up in these new burdens to add value within the business, not detract value."

Out of reach

One of the key concerns in the lead up to and in the wake of the deal is how the UK will regulate chemicals. There had been calls from industry and environmental groups that in the interests of environmental protection and cost savings the UK should negotiate an agreement to remain wedded to the EU REACH chemicals regulation.

Instead, the UK opted to create a shadow UK REACH, requiring chemicals companies to duplicate their efforts to work in both markets. UK companies seeking to sell into the EU had to transfer their REACH registrations to the EU by 31 December. In January, the European Chemical Agency (ECHA) said 20% of registrations in the UK had not been transferred and will be revoked.

[Read More](#)

The Chemical Engineer, 28 January 2021

<https://www.thechemicalengineer.com/news/brexit-relief-rapidly-gives-way-to-fresh-concerns-mag/>

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REACH Update

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Health, environment, and justice organizations seek clarification from ECHA on nano and biocidal-treated products

2021-01-26

On January 20, 2021, Health Care Without Harm (HCWH) Europe and 12 other health, environment, and justice organizations sent a letter to Bjorn Hansen, Executive Director of the European Chemicals Agency (ECHA) "seeking clarifications on both the applicable legal framework and risk management measures in place, for nano/biocidal-treated articles in the context of the current COVID-19 pandemic." The letter states that "[a]s a result of laboratory tests supposedly showing antiviral activity against a range of viruses, the use of biocides/nanoparticles to combat SARS-CoV-2 transmission (particularly silver) is rapidly growing." According to the letter, the European Union (EU) market currently includes products such as face masks treated with silver, zinc oxide, or copper nanoparticles; "anticovid" paper containing nanostructured zinc-silver; and nanosilver-containing surface disinfectants. The letter states that according to market research, "the demand is growing for antimicrobial and antiviral nanocoatings as (new) products come to the market." The organizations seek clarification on several issues, including the following ones regarding nanomaterials:

While articles treated with a biocide placed on the EU market do not need authorization, individual active biocidal substances must be approved (or reviewed) under the Biocidal Products Regulation (BPR) before being used in the EU.

What measures are/will be taken regarding nano-treated masks sold on the EU market for example?

Under the BPR, when a treated article placed on the market refers to the biocidal properties of the active substances contained therein, the label should include a statement that the treated article incorporates biocidal products, the names of the active substances, and if present, the names of each biocidal (nano-)substance followed by the word "nano" in brackets. The recently published report on the first harmonized enforcement project (BEF-1) held under the umbrella of the BPR Subgroup of the Enforcement Forum reveals that in 2019 the quality of information provided on these labels was inadequate in 36% of cases, and that basic information, such as the name of the biocidal active substance used for treatment of the product, was often missing.

The letter states that according to market research, "the demand is growing for antimicrobial and antiviral nanocoatings as (new) products come to the market."

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REACH Update

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As this report only covered treated articles in 2019, and considering the significant rise of biocide/nanomaterial treated articles in 2020, is ECHA considering an extra compliance check in the near future?

[Read More](#)

Nano and Other Emerging Chemical Technologies Blog, 26 January 2021

https://nanotech.lawbc.com/2021/01/health-environment-and-justice-organizations-seek-clarification-from-echa-on-nano-and-biocidal-treated-products/?utm_source=Bergeson+%26+Campbell%2C+P.C.+Nano+and+Other+Emerging+Chemical+Technologies+Blog

Budget cut no impediment for EU chems regulator's role in unstoppable Green Deal - chief

2021-01-28

Post-pandemic working practices and Commission allocations for additional projects will allow the EU's chemicals regulator to just about fund itself after an 8% per year cut in its direct financing, according to its executive director.

Bjorn Hansen, chief at the European Chemicals Agency (ECHA) since 2018, said that the current 2021-2027 EU budget – the multiannual financial framework (MFF) – will mean the regulator's annual budget will stand at €113m/year, adjusted for inflation.

Roughly one third of ECHA's income comes from chemicals registrations, those applied for by companies who want to produce and trade chemicals in the 27-country bloc, as set out by the regulatory regime Reach.

Details of ECHA's financing can be found on its website (opens new tab).

However, Hansen was optimistic because, despite the deep cut in EU funding, ECHA's "main crown jewel" – its 600-strong workforce – will remain unchanged.

The savings, he said, will come from new post-pandemic working practices, as 50% of those 600 employees are set to remain permanently home-based.

Hansen also spoke about the role the chemicals industry and its regulator can play in the implementation of the EU's Green Deal, which aims to decarbonise the economy by 2050, and about the regulatory conundrum the UK finds itself in post-Brexit.

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REACH Update

FEB. 05, 2021

The interview was conducted on 26 January 2021.

PANDEMIC HOME-WORKING TO STAY

Like many private companies, ECHA realised in 2020 that home-working is viable as a permanent option; it is not only the home offices that have rapidly sprung up globally over the last 10 months, but everything linked to former office working habits, which are already fading into history.

Hansen said that not only 50% of ECHA employees will be permanently home based, but also that presidential meetings will be reduced by 50%, and this all will have a knock-on effect on office maintenance spending.

He said this would make it easier to cope with the 8% cut in the ECHA budget.

"[In the final MMF outcome] We ended up not as bad as we had feared; we got a substantial financial cut, but we didn't get a cut in our main crown jewel: our staff and their knowledge. On one hand, we did our homework analysing where spending could be cut going forward," said Hansen.

"On the other, the pandemic saved us a lot of money, because we do not travel, we don't hold meetings physically – paying flights and hotels for experts – which means substantial costs savings. In our Helsinki headquarters, we have saved a lot on things like catering, security, etcetera."

With half the workforce remote and half the meetings held virtually, half of those savings will obviously remain a permanent feature in ECHA's day-to-day management.

ECHA's work may be affected, however, by the amount of outsourcing to contractors it has had to cut; Hansen calls them "interims", or experts normally hired for a period to do specific tasks, which have been reduced by 40 staff members.

The EU's MMF does contemplate, however, additional financing for any extra tasks ECHA may be told to undertake. In a previous interview with ICIS, Hansen had complained that new bodies like the Observatory for Nanomaterials (EU-ON), or the waste and microplastics directives would add pressure on an overstretched regulator.

"[Those new tasks] are now coming with fresh resources. If we get an additional task, we get more staff. The cut in interims, however, has impacted on our work and we had to scale down some activities," said Hansen.

The savings, he said, will come from new post-pandemic working practices, as 50% of those 600 employees are set to remain permanently home-based.

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REACH Update

FEB. 05, 2021

[Read More](#)

ICIS, 28 January 2021

<https://www.icis.com/explore/resources/news/2021/01/28/10600191/budget-cut-no-impediment-for-eu-chems-regulator-s-role-in-unstoppable-green-deal-chief>

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Janet's Corner

FEB. 05, 2021

Not full moon

2021-02-05



d.

<http://unearthedcomics.com/comics/not-full-moon/>

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Hazard Alert

FEB. 05, 2021

Sulfuric acid

2021-02-05

Sulfuric acid is a highly corrosive strong mineral acid with the molecular formula H_2SO_4 . It is a colourless to slightly yellow viscous liquid which is soluble in water at all concentrations. Sometimes, it may be dark brown as it gets dyed during industrial production process in order to alert people to its hazards. Sulfuric acid is a diprotic acid which may show different properties depending upon its concentration. Its corrosiveness on metals, stones, skin, eyes and flesh or other materials can be mainly ascribed to its strong acidic nature and, if concentrated, strong dehydrating and oxidising properties. [1]

USES [2]

The main use of sulfuric acid is in the production of phosphate fertilisers. It is also used to manufacture explosives, other acids, dyes, glue, wood preservatives, and automobile batteries. It is used in the purification of petroleum, the pickling of metal, copper smelting, electroplating, metal work, and the production of rayon and film.

IN THE ENVIRONMENT [2,3]

Sulfuric acid will exist as particles or droplets in the air if released to the atmosphere. It dissolves when mixed with water. It has moderate acute (short-term) toxicity on aquatic life. Sulfuric acid is very corrosive and would badly burn any plants, birds or land animals exposed to it. It has moderate chronic (long-term) toxicity to aquatic life. Chronic effects on plants, birds or land animals have not been determined. Small quantities of sulfuric acid will be neutralised by the natural alkalinity in aquatic systems. Larger quantities may lower the pH for extended periods of time. Sulfuric acid is removed from the air in rain and contributes to the formation of acid rain.

SOURCES AND ROUTES OF EXPOSURE [2,4]

Sources of Exposure

The primary sources of sulfuric acid emissions are the industries that manufacture it or use it in production. Some of the industries that use it in production are the metal smelters, phosphate fertiliser producers, oil refiners, the chemical industry, battery manufacturers, manufacturers or fabricated metal products, manufacturers of electronic components, and

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manufacturers of measuring and controlling devices. These are emissions to the air unless there is a spill to water or land. Sulfuric acid spilt to land or water may result in emissions of the acid to air. Other possible emitters of sulfuric acid are home and larger pool treatment, the disposal of automobile batteries, electroplating facilities, electronics, semiconductor and circuit board production, potato growers, and water and waste water treatment. These emissions may be to the soil, water, or air. Sulfuric acid may be also produced as a result of sulphur dioxide reacting with other chemicals in the air.

Routes of Exposure

The major routes of exposure to sulfuric acid are via inhalation of contaminated air, dermal or ocular exposure and ingestion. While it is not absorbed through the skin, contact of the skin and eyes with strong concentrations may cause serious burns.

HEALTH EFFECTS [2,4,5]

Acute Effects

Sulfuric acid causes irritation to the eyes, skin, nose, throat; pulmonary oedema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis. The substance is very corrosive to the eyes, the skin, and the respiratory tract and attacks the enamel of the teeth. Inhalation may result in a burning sensation, sore throat, cough, laboured breathing, shortness of breath and lung oedema. Symptoms may be delayed. Skin contact may result in redness, pain, blisters, serious skin burns. Eye contact may result in redness, pain and severe deep burns. Corrosive on ingestion and may result in abdominal pain, burning sensation, shock or collapse.

Chronic Effects

Lungs may be affected by repeated or prolonged exposure to an aerosol of sulfuric acid. There is a risk of tooth erosion upon repeated or prolonged exposure to an aerosol of this substance.

Carcinogenicity

The International Agency for Research on Cancer has classified 'occupational exposures to strong-inorganic-acid mists containing sulfuric acid' as carcinogenic to humans.

Sulfuric acid is a highly corrosive strong mineral acid with the molecular formula H_2SO_4 .

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SAFETY [6]

First Aid Measures

Ingestion:

- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Avoid giving milk or oils.
- Avoid giving alcohol.
- If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomit.

Eye Contact:

- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.

Skin Contact:

- Immediately remove all contaminated clothing, including footwear.
- Flush skin and hair with running water (and soap if available).

Inhalation:

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.

Exposure Controls and Personal Protection

Engineering Controls

For flammable liquids and flammable gases, local exhaust ventilation or a process enclosure ventilation system may be required. Ventilation equipment should be explosion-resistant.

Respirator

Type AENO-P Filter of sufficient capacity should be used

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Personal Protective Equipment

- Eyes: Safety glasses with side shields and chemical goggles.
- Hands: Chemical protective gloves, such as PVC should be worn. Suitability and durability of glove type is dependent on usage. Factors such as frequency and duration of contact and chemical resistance of glove material should be considered.
- Feet: Safety footwear or safety gumboots should be worn.
- Other safety equipment advised include overalls and PVC Apron.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

REGULATION

United States [7]

Exposure Limit	Limit Values	HE Code	Health Factors and Target Organs
OSHA Permissible Exposure Limit (PEL) - General Industry See 29 CFR 1910.1000 Table Z-1	1 mg/m ³ TWA	HE10	Lung changes
		HE11	Cough
OSHA PEL - Construction Industry See 29 CFR 1926.55 Appendix A	1 mg/m ³ TWA	HE10	Lung changes
		HE11	Cough
OSHA PEL - Shipyard Employment See 29 CFR 1915.1000 Table Z-Shipyards	1 mg/m ³ TWA	HE10	Lung changes
		HE11	Cough

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Exposure Limit	Limit Values	HE Code	Health Factors and Target Organs
National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL)	1 mg/m ³ TWA	HE3	Dental erosion
		HE10	Pulmonary fibrosis, bronchiectasis, and emphysema
		HE11	Pulmonary oedema
		HE14	Respiratory irritation, cough
American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2004)	0.2 mg/m ³ TWA (thoracic particulate mass) A2 (when contained in strong inorganic acid mists)	HE3	Dental erosion
		HE10	Pulmonary fibrosis, bronchiectasis, and emphysema
		HE14	Marked eye, nose, throat, bronchial, and skin irritation
CAL/OSHA PELs	0.1 mg/m ³ TWA 3 mg/m ³ STEL		Irritation of the upper and lower respiratory tract

Australia [2]

Safe Work Australia: Safe Work Australia has set an eight-hour time weighted average (TWA) exposure limit of 1 mg/m³, with a short term exposure limit (STEL) of 3 mg/m³.

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Gossip

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The Atlantic Ocean is widening. Here's why.

2021-01-29

The Atlantic Ocean is getting wider, shoving the Americas to one side and Europe and Africa to the other. But it's not known exactly how.

A new study suggests that deep beneath the Earth's crust, in a layer called the mantle, sizzling-hot rocks are rising up and pushing on tectonic plates — those rocky jigsaw pieces that form Earth's crust — that meet beneath the Atlantic.

Previously, scientists thought that the continents were mostly being pulled apart as the plates beneath the ocean moved in opposite directions and crashed into other plates, folding under the force of gravity. But the new study suggests that's not the whole picture.

The research began in 2016, when a group of researchers set sail on a research vessel to the widest part of the Atlantic Ocean between South America and Africa; in other words, to "the middle of nowhere," said lead author Matthew Agius, who was a postdoctoral researcher with the University of Southampton in the U.K. at the time, but is now at the Roma Tre University in Italy.

The spot is not a particularly popular route for travel, Agius said, noting that sometimes days would go by without seeing a single other ship or a plane. Interaction is limited to the occasional whales and dolphins that swim by and a fleeting signal from the ship's Wi-Fi. Lightless nights blanket the vast sea in an unobscured view of the galaxy and stars — and it's very, very quiet, Agius said.

But this vast, empty stretch of ocean rests upon an incredibly important geological spot: the mid-Atlantic ridge, the planet's largest tectonic boundary that extends 10,000 miles (16,093 kilometers) from the Arctic Ocean to the southern tip of Africa. This is the spot where the South American and the North American Plates move apart from the Eurasian and African plates, at a speed of about 1.6 inches (4 centimeters) a year, extending the Atlantic Ocean.

Listening to rumbles

Agius and his team spent five weeks sailing across a small portion of the ridge — about 621 miles (1,000 km) — dropping seismometers (instruments that detect seismic waves or vibrations such as those from earthquakes) onto the seafloor.

This is the spot where the South American and the North American Plates move apart from the Eurasian and African plates, at a speed of about 1.6 inches (4 centimeters) a year, extending the Atlantic Ocean.

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A year later, the researchers collected the seismometers.

Until now, “we never had good images of what’s happening beneath the ocean,” Agius said. Since seismic waves behave differently depending on the material they move through, the researchers could use the data to create images, allowing them to peer into various layers of the Earth. In that year of listening, the seismometers picked up vibrations from earthquakes that propagated from various parts of the world and through Earth’s deep mantle — a layer of mostly solid, hot rock about 1,800 miles (2,900 km) thick.

While the team’s original goal was to learn about how the plates were born and how they aged, and they really intended to study shallower depths of the Earth, the researchers found evidence of a deeper phenomenon at play.

They found that in that area within the ridge, the mantle transition zone — a higher-density region that serves as a gatekeeper between the upper and lower layers of the mantle — was thinner than average which likely means it was hotter than normal. The hotter temperatures of the transition zone likely facilitated an “upwelling” of hot rock from Earth’s lower mantle to its upper mantle that actively pushed the plates apart, Agius said.

Researchers previously thought that plates mainly diverged from each other due to a “pulling” at subduction zones, places where plates collide and one sinks beneath the other, recycling material into the mantle, Agius said. So if you have one plate being pulled on one side (and crashing with another plate at a subduction zone), and another plate being pulled to the other side (again crashing with another plate at a subduction zone), it would create ridges in the middle, where the hot material from below rises to fill the resulting gap.

“That is still happening, but it was thought that the ridges are an effect of that process,” he said. But their findings suggest that as subduction zones pull the plates apart, upwellings beneath the ridges might be actively helping to push them apart. However, it’s unclear if this process is just related to the mid-Atlantic ridge or if all the ridges around the world experience the same thing, Agius said. “The pulling is still there, just we would like to determine now if all the ridges are experiencing pushing as well.”

Pushing and pulling

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“The findings “add a piece of the puzzle towards understanding flow in Earth’s mantle,” said Jeroen Ritsema, a professor in the department of Earth and Environmental Sciences at the University of Michigan, who was not a part of the study.

And though their analysis is “excellent,” the study is limited in scope, he said. They looked at only a small portion of the Atlantic seafloor, so it’s not clear if their findings would hold true along the entire mid-Atlantic ridge or even in other mid-ocean ridges. “It is difficult to infer global-scale rock flow in Earth’s mantle from only a single viewpoint,” Ritsema told Live Science. “It is like peeking through a keyhole and trying to find out what furniture is in the living room, kitchen and the bedrooms upstairs.”

What’s more, there could be some other explanations for the warmer-than-normal transition zone.

It’s a very “remarkable data set that they collected at great pains,” said Barbara Ramonowicz, a professor of the University of California, Berkeley’s Earth and Planetary Science Graduate School and professor emeritus of the College de France in Paris, who was also not a part of the study. “I have no doubt about their analysis. ...I have reservations about their interpretation,” Ramonowicz told LiveScience. There are well-known plumes nearby that could have been offset and caused that area to heat up, she said.

Vedran Lekic, an associate professor at the University of Maryland’s Department of Geology who was also not involved with the study, agrees that their explanation is plausible “but not the only possible one to explain the findings.” But if the findings are replicated elsewhere, it “might bring into question our prevailing view of ridges,” he added.

These and other similar findings could also alter our maps. Some 300 million years ago, all seven continents were smooshed together into a single supercontinent known as Pangaea. Over millions of years, plates split the continents, creating ocean boundaries and the modern map. But the spreading of the Atlantic Ocean and the shrinking of the Pacific Ocean is slowly, inconspicuously aging those maps and making them increasingly inaccurate. “The maps will alter a little bit [for now] and over millions and millions of years will alter significantly,” Agius said.

The findings were published in the journal Nature on Jan. 27.

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Originally published on Live Science.

[livescience.com](https://www.livescience.com), 29 January 2021

<https://www.livescience.com>

Your amazing thing is about 2 million years old

2021-01-28

The human thumb is a nimble wonder, allowing us to make tools, sew clothing, and open pickle jars. But just how and when this unique digit evolved has long been a mystery. Now, a new study modeling muscle in fossilized thumbs suggests about 2 million years ago, our ancient ancestors evolved a uniquely dexterous appendage while our other close relatives remained ... all thumbs.

It's a "thorough, robust analysis," says Tracy Kivell, a paleoanthropologist at the University of Kent who was not involved with the work. But she and others caution that the research is too preliminary to provide a true smoking gun.

Figuring out how ancient thumbs worked isn't easy. Fossils don't preserve muscles, so most previous attempts to estimate ancient dexterity relied on how closely our ancient relatives' hand bones resembled our own. Hand bones are also small and relatively rare in the fossil record. But resemblance can be deceiving: Depending on how the muscles are connected, some species with similar bone anatomy might have very different grip strengths, and vice versa.

To analyze ancient thumbs on their own terms, paleoanthropologists at the University of Tübingen digitized the fossil thumb bones from a variety of ancient hominins, a group that includes all species in our own genus, *Homo*, as well as other very closely related species. The researchers looked at bones from two early modern humans and four Neanderthals from the past 100,000 years, and the diminutive, cave-dwelling *H. naledi* (from about 250,000 to 300,000 years ago). They also looked at a sister genus to *Homo* called the Australopithecines, which included *Australopithecus afarensis*, *A. africanus*, and *A. sediba*.

The researchers then used 3D computer software to digitally reconstruct on the fossils a muscle known as the *opponens pollicis*—which allows your thumb to flex inward—to its attachment site at the base of the palm. They simulated the approximate force the muscle could exert, with more force equating a better, more precise grip, for example, when holding steady a needle and thread or swinging a hammer.

Figuring out how ancient thumbs worked isn't easy.

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To validate their model, the scientists applied the same approach to the thumb bones of modern humans and chimpanzees. They found that their model's force estimates matched up with the known capabilities of the two species.

All the members of our genus *Homo* they investigated had basically the same thumb grip strength as modern humans, the researchers report today in *Current Biology*.

The team also found modern-looking thumb movement in two hominin specimens from the Swartkrans site in South Africa, which have been dated to about 2 million years ago. Because their skeletons are so incomplete, no one has been certain which species or genus they belonged to. The authors argue their humanlike thumb is good evidence they may be members of *Homo*, though they admit the jury is still out. Either way, the Swartkrans fossils represent the earliest known humanlike thumbs in the fossil record, the authors say.

But the other human relatives in the study, the Australopithecines, had much weaker thumbs, the team found, closer to those of modern chimpanzees. That's a bit surprising in the case of *A. sediba*—which, like the Swartkrans fossils, dates to about 2 million years ago. Its humanlike hand proportions caused many to believe it may have possessed humanlike dexterity. "Even though Australopithecines, including *A. sediba*, may have exhibited tool-related behaviors, they had not yet developed a humanlike level of efficiency," the authors tell *Science*.

Overall, the work suggests the modern human thumb arose about 2 million years ago in the *Homo* genus, the researchers conclude. This may have allowed ancient humans to get better and better at making stone tools, ultimately surpassing the other hominins.

Evie Vereecke, an anthropologist and anatomist at KU Leuven, praises the authors' approach. But she says the findings should be treated with caution. "We know that dexterity is not only due to one muscle."

Laurent Vigouroux, a biomechanics researcher at Aix-Marseille University who studies the mechanics of the human grip, agrees. He notes there are more than 10 different muscles that contribute to thumb movement, and it's possible that weaker *opponens pollicis* in some species may have been compensated for by some other muscle or muscles.

Still, both Vigouroux and Vereecke say the study's basic approach is likely to be useful for the field—giving anthropologists a kind of common

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language for analyzing the muscular characteristics of fossils. “Not long ago, everyone who found fossilized remains had their own interpretation” of the long-gone musculature, Vereecke says. “This could help bring them onto the same page.”

sciencemag.org, 28 January 2021

<https://www.sciencemag.org>

Lizard-like tuatara carry two distinct mitochondrial genomes

2021-01-29

The lizard-like tuatara already was an oddball. Its superpowers include a century-long lifespan, resistance to many diseases and a unique tolerance (for a reptile) to the cold. Now, it turns out, a part of the animal’s genetic instruction book is as weird as its life history — and may help explain its ability to withstand extreme temperatures.

Tuatara have two distinct copies of the genetic instruction manual for making mitochondria, researchers report January 29 in *Communications Biology*.

“It’s the first evidence of a full additional copy of the mitochondrial genome in a vertebrate,” says Chris Schneider, a herpetologist at Boston University not involved in the study. Other vertebrates have only one copy of a mitochondrial genome. Mussels are the only other animal ever found to have two.

Mitochondria are tiny energy factories, and their genetic material is usually important in building the structures and keeping them running. Recent studies show that mitochondrial DNA plays major roles in aging and various human cancers, as well as metabolic, muscular and neurodegenerative diseases (SN: 10/24/12). Studying the mitochondrial genomes of other animals could offer clues to the inner workings of human disease, the researchers say.

Bottom of Form

“The mitochondrial genome is much more important than people realize, given its association with aging and disease,” says Robert Macey, a genomicist at the Peralta Genomics Institute in Oakland, Calif. “How that operates in an animal that ages slowly in a cool environment might tell us something significant about how mitochondria work.”

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Efforts to decode the tuatara’s genetic makeup began in 2012, with the launch of the Tuatara Genome Project led by Neil Gemmell, an evolutionary biologist at the University of Otago in Dunedin, New Zealand. After getting the blessing of the Maori people to sample the reptile’s blood (tuatara are a taonga (special treasure) to the Maori), the team found the its genome to be 50 percent larger than the human genome (SN: 8/5/20).

This discovery led to deeper exploration of the mitochondrial part of the genome. Most techniques that decipher, or sequence, DNA chop it into small pieces, “read” it, then reassemble the pieces. That provides a high resolution look at individual puzzle pieces. Piloting a new technique that reads long DNA segments, Macey’s lab sequenced the tuatara’s mitochondrial genome in one fell swoop, showing its overall structure. The technique, called long-read sequencing, “is undoubtedly the future of gene sequencing, that we can sequence whole molecules in one pop!” Macey says.

Dan Mulcahy, a molecular biologist at the Smithsonian’s Global Genome Initiative in Washington, D.C., and Macey were mulling over the data when Mulcahy recalls saying, “I think there may be two mt-genomes!”

The revelation came from comparing both the chopped puzzle pieces and the overall structure, and noticing that sections from the same part of the mitochondrial DNA had striking differences in their gene sequences — like the way the notes of song might be arranged differently by two different composers. The variation raised eyebrows; mitochondrial DNA is usually inherited only from a mother’s egg, so the scientists expected to see a single copy of the mitochondrial genome, not two copies like they would see in nuclear DNA, which is inherited from both mother and father.

Together, the scientists painstakingly assembled two fully functional mitochondrial genomes. They found the genomes differed by an eye-popping 10.4 percent. In comparison, human and chimpanzee mitochondrial genomes differ by 8.9 percent. “The tuatara’s arrangement of genes is unlike any other vertebrate,” Mulcahy says.

When Lara Urban, a genomicist at the University of Otago, analyzed which sets of genes differed between the two genomes, she noticed changes in ones related to metabolism. An animal’s cell metabolism adjusts to help it cope with environmental extremes. The double mitochondrial genome might give tuatara flexibility in how their metabolisms respond to temperature extremes, the scientists say.

Other vertebrates have only one copy of a mitochondrial genome.

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“The tuatara has the most complicated mitochondrial genome I’ve ever seen,” Macey says. Finding the genetic basis for the animal’s metabolic feats could clarify the mitochondrial genome’s function, helping to find treatments for human metabolic diseases.

sciencenews.org, 29 January 2021

<https://www.sciencenews.org>

Maryland lawmakers eye statewide ban on balloon releases

2021-01-25

Democrats and Republicans may not agree on much these days, but in the Maryland General Assembly lawmakers of both parties have come together to protect sea turtles, shorebirds and other wildlife.

One of the first bills to be heard during the 90-day legislative session that began Jan. 13 is a bipartisan measure that would impose a statewide ban on intentional releases of helium-filled balloons. A violation would be punishable by a fine of up to \$250.

Backers said the legislation, HB391, is needed because what goes up eventually comes down, where it poses a pernicious threat to animals, particularly marine life.

“When a balloon is released, best case, it becomes litter. Oftentimes it’s much worse,” said the bill’s lead sponsor, Del. Wayne Hartman, a Republican representing Wicomico and Worcester counties on the Eastern Shore. “Unfortunately, [balloons] are often confused as food for sea life,” he said, “and the ribbons and so forth attached can cause entanglement.” The outcome for marine life is often fatal, he pointed out.

Helium-filled latex balloons can drift for miles before coming to Earth — or, just as likely, to water. Helium-filled foil balloons (commonly known by the tradename Mylar) remain buoyant much longer and can stay aloft for weeks and drift for hundreds of miles, Hartman explained during a Jan. 15 hearing before the House Environment and Transportation Committee.

A recent survey by the nonprofit group Oceana tallied nearly 1,800 reports nationwide of 40 different species of animal either swallowing or becoming entangled in some type of plastic. Balloons were among the most frequent plastic items involved. Nearly half of the incidents involved sea turtles, and close to 90% of all the affected animals have been either endangered or threatened species, Oceana reported.

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In Maryland, Hartman recalled, a “roundup” organized by a family from Berlin collected more than 2,800 balloons in 19 months from the ocean and beaches. One youngster found 20 balloons in a single day on Assateague Island.

The bill — cosponsored by two other Eastern Shore Republicans and four Western Shore Democrats — has drawn enthusiastic support from a bevy of environmental and animal-welfare groups. Similar bills easily passed in the House and Senate last year but failed to get through both chambers before the legislative session shut down weeks early because of the coronavirus pandemic.

Three Maryland counties — Queen Anne’s, Wicomico and Montgomery — and the town of Ocean City already ban balloon releases. Advocates say a statewide ban is needed because airborne balloons frequently cross localities’ and even state borders. At least five other states, including Virginia, have similar bans.

Other balloon bans have outlawed intentional releases of multiple balloons, but the Maryland bill applies to the intentional release of even a single one. Releasing more than one multiplies the penalties. There are a handful of exemptions in the Maryland bill, including releases by anyone under 13 years of age or for scientific or educational purposes. The sponsor also agreed to exempt releases by ham radio operators when done as part of their hobby.

Lawmakers in other Bay states have been weighing similar actions. Legislation pending in the Virginia General Assembly, HB2159, would expand that state’s current law outlawing mass releases to apply even to even a single balloon. In the Delaware General Assembly, a bill introduced in the Senate this month, SB24, would impose a penalty of at least \$250 and 8 hours of community service for intentionally releasing 5 or more balloons. It would also make even smaller releases subject to littering fines. An online petition has been started urging Pennsylvania lawmakers to take action as well.

Cindy Dillon of the Maryland Sierra Club, testifying in Annapolis in favor of that state’s legislation, noted that balloons are often released to celebrate some happy occasion, such as a wedding or graduation, or as a tribute to a lost loved one. She suggested there are other, less potentially harmful ways to honor those individuals, such as planting a tree or lighting candles, or even drumming.

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The latter brought a mild protest from the committee's chairman, Del. Kumar Barve.

"I love the bill," the Montgomery County Democrat said, "but I certainly don't want to encourage people to start drumming."

bayjournal.com, 25 January 2021

<https://www.bayjournal.com>

FDA places all alcohol-based hand sanitizers from Mexico on 'import alert'

2021-01-27

(CNN)The US Food and Drug Administration has placed all alcohol-based hand sanitizers coming from Mexico on a countrywide "import alert" until it is able to review the products' safety, the agency said.

Alcohol-based hand sanitizers from Mexico will now be subject to heightened scrutiny, and FDA staff may detain shipments, according to a news release.

"Over the course of the ongoing pandemic, the agency has seen a sharp increase in hand sanitizer products from Mexico that were labeled to contain ethanol (also known as ethyl alcohol) but tested positive for methanol contamination," the FDA said.

Methanol, or wood alcohol can be toxic when absorbed through the skin and can be life-threatening if ingested. It is not an acceptable ingredient in hand sanitizer in the United States, according to the FDA.

"Consumer use of hand sanitizers has increased significantly during the coronavirus pandemic, especially when soap and water are not accessible, and the availability of poor-quality products with dangerous and unacceptable ingredients will not be tolerated," Judy McMeekin, FDA associate commissioner for regulatory affairs, said in the release Tuesday.

"Today's actions are necessary to protect the safe supply of alcohol-based hand sanitizers. We will continue to work with our stakeholders to ensure the availability of safe products and to communicate vital information with the health and safety of U.S. consumers in mind."

close dialog

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From April through December 2020, the FDA found that 84% of the samples that were analyzed were not in compliance with the FDA's regulations and more than half of the samples were found to contain toxic ingredients, including methanol and/or 1-propanol, at dangerous levels, according to the release.

edition.cnn.com, 27 January 201

<https://www.edition.cnn.com>

Schizophrenia is 2nd highest risk factor for dying of COVID-19, after age

2021-01-29

Schizophrenia may be one of the highest risk factors for dying from COVID-19, second only to age, according to a new study.

Previous studies had found that people with mental illnesses, particularly depression and schizophrenia — a condition that causes distortions in thinking and perception — had a higher risk of becoming infected with SARS-CoV-2, the virus that causes COVID-19. But it was not known whether mental disorders were also associated with a risk of dying from COVID-19.

In the new study, researchers looked at health records from 260 outpatient clinics and four hospitals across New York City, based on data published by the New York University electronic health record; Of 26,540 patients tested (around 4,500 patients were excluded for various reasons), 7,348 adults tested positive COVID-19 between March 3 and May 31.

They then divided the patients with a reported psychiatric disorder into one of three categories — schizophrenia spectrum, mood disorder or anxiety disorder — and compared them with COVID-19 patients who weren't diagnosed with any psychiatric disorder. They adjusted their findings for sex, age, race and known risk factors for COVID-19: high blood pressure, diabetes, heart conditions, chronic obstructive pulmonary disease, chronic kidney disease, smoking and cancer.

PLAY SOUND

Of the more than 7,000 adults who tested positive for the coronavirus during that time, 75 patients had a history of schizophrenia; 564 had a history of a mood disorder; and 360 had a history of an anxiety disorder.

Overall, 864 of the COVID-19 patients died or were discharged to hospice within 45 days of their diagnosis.

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Overall, 864 of the COVID-19 patients died or were discharged to hospice within 45 days of their diagnosis.

The researchers did not find an association between anxiety or mood disorders and death from COVID-19. But they found that people with schizophrenia were about 2.7 times more likely to die from COVID-19 than people without that mental disorder — the second-highest risk factor after age.

By comparison, patients between the ages of 45 and 54 were 3.9 times more likely to die from COVID-19 than younger patients (and that risk doubled every 10 years of age after 54), regardless of whether they had a mental disorder. Patients with heart failure or diabetes had a 1.65 times and 1.28 times higher risk of dying from COVID-19, respectively.

Expected but surprising

But why would a mental disease be linked to the risk of dying from COVID-19?

“It is both expected but also surprising,” said senior author Dr. Donald Goff, a professor of psychiatry at the NYU School of Medicine. Research has shown that people with schizophrenia have shortened life expectancies by as much as 20 years, on average; and many die earlier from pneumonia and viral illnesses, he said.

But that decrease in life expectancy was thought to mostly be a reflection of other medical risk factors and behaviors that typically accompany schizophrenia, including obesity, heart disease and cigarette smoking. In this study, people with schizophrenia still had a higher risk of mortality, despite the authors having adjusted for those conditions.

“It seemed as though there’s something about either the illness of schizophrenia or possibly medications that causes them to be at really high risk of mortality,” Goff told Live Science. For example, perhaps the illness or medications are disrupting the immune system, he said. Previous research has found that people with schizophrenia can have altered immune responses and variations in the genes that regulate the body’s immune response to infections.

“This is a highly interesting study, especially with regard to the role of the immune system,” said Dr. Norbert Müller, a professor of psychiatry at the Ludwig Maximilian University of Munich, Germany, who was not involved with the study. Some psychiatrists speculate that schizophrenia is associated with the activation of the immune system and pro-

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inflammatory signalling molecules known as cytokines, he said. A common cause of COVID-19 death is an overreaction of those cytokines, also known as a cytokine storm.

“Such a mechanism could also play a role in schizophrenia and be a common pathway of schizophrenia and fatal course in COVID-19,” Müller told Live Science. But the genes that instruct and regulate the immune response could also play a role, he added. Still, the study was limited by the low number of schizophrenia patients, he said, and also by the lack of data on patients’ psychosis medications (which the authors also mention).

Also, the data included only patients who had access to treatment at the NYU health-care system, and it was collected during New York City’s peak outbreak when mostly high-risk and symptomatic people were being tested.

“There were such high rates, and the whole system was close to being overwhelmed and the treatments were not as effective as the treatments are now,” Goff said. Since then, “the absolute rates of mortality have dropped across the board, but we think this continues most likely to be true that people with schizophrenia are at higher risk.”

Goff and his team are now conducting more research to figure out whether there is a biological reason why patients with schizophrenia may have a higher risk. But for now, “we thought it was important to bring this to people’s attention,” Goff said. People with schizophrenia should be among those “prioritized for vaccines,” he added.

The findings were published on Jan. 27 in the journal JAMA Psychiatry.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 29 January 2021

<https://www.livescience.com>

Spotted and oddly striped zebras may be a warning for species’ future

2021-01-21

Anyone can tell you that zebras have distinctive black and white stripes. But in some cases, these African equines sport unusual color patterns, such as large, black splotches or golden coats with light-colored stripes. Spotted zebras are appearing as well. In 2019 in Kenya’s Masai Mara

A lack of gene flow can lead to inbreeding and ultimately infertility, disease, and other genetic defects.

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National Reserve, scientists recorded a polka-dotted foal, with white spots covering its dark-brown body.

Such aberrations—often caused by genetic mutations that alter the production of melanin, a natural pigment—are generally rare among mammals. So biologist Brenda Larison found it striking that an unusually high number—an estimated 5 percent—of plains zebra living near Uganda's Lake Mburo were abnormally striped.

Though plains zebras are the least threatened of the three species, their numbers have dropped by 25 percent since 2002, with around 500,000 animals ranging from Ethiopia to South Africa. Habitat fragmentation caused by fences, roads, and human development have squeezed zebra populations, like the one in Lake Mburo, into small pockets of land, preventing some of the animals from migrating between herds.

Migrating infuses populations with new genes, making it key to a species' long-term survival. A lack of gene flow can lead to inbreeding and ultimately infertility, disease, and other genetic defects.

"The observation [of the oddly patterned zebras] led me to wonder: Is part of the reason that I'm seeing so many is because this population is inbred?" says Larison, who studies the evolution of zebra stripes at the University of California, Los Angeles. (Read more about Larison's research in her own words.)

To find out, Larison and colleagues ran genetic analyses on 140 individual plains zebras—including seven animals with unusual coat patterns—from nine locations in Africa, including Namibia's Etosha National Park and South Africa's Kruger National Park.

Their study, published recently in the journal *Molecular Ecology*, found that smaller, more isolated populations of zebras had lower genetic diversity—not a surprise. But the study also revealed these isolated groups were more likely to produce abnormally striped zebras, suggesting these genetic mutations are caused by their poor genetic diversity.

While the study only looked at seven animals with odd patterns, the results could be a visual warning about the plains zebra's future, says Larison.

"Even though plains zebras aren't highly threatened, these genetic issues often show up before really problematic things start happening," she says.

Genetic gaps

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It's possible odd stripes could make the zebras more obvious to predators; for instance, most recorded instances of polka-dotted zebras are as foals, not adults. Within their family groups, however, zebras don't much seem to mind who's striped and who's spotted, notes Larison, whose latest research suggests zebra stripes help the animals avoid biting flies.

The more immediate concern, she says, is the plains zebra's genetic health. For their analysis, Larison and her colleagues used advanced genetic sequencing techniques to closely study differences between not only inbred zebras, but also the zebra populations in distinct locations. (See pictures of a white giraffe and other unusually pale animals.)

"We found that there are populations that are possibly diverging more than they would under normal circumstances, because of human population pressure," says Larison, whose work is supported by the National Geographic Society.

In other words, zebras are becoming genetically closer within their populations, but these populations are growing more distant genetically—mirroring their physical separation. This could eventually lead to new subspecies of plains zebra.

A conservation complication

That's worrisome, says Desire Dalton, who studies wildlife genetics at the South African National Biodiversity Institute in Pretoria, because one of zebra conservationists' main tools is translocation—moving individual members of one population to breed in another population.

If the populations are too genetically different from each other, though, the opposite of inbreeding can occur. Outbreeding, as it's called, causes abnormalities from genes being too dissimilar.

There's conflicting research on which plains zebra populations might be on their way to becoming genetically distinct, or subspecies. Scientists have not yet arrived at a consensus about how to define and group these subspecies.

But she agreed with Larison's team that defining these groups is critical for managing the species. (Read how people are helping Grevy's zebra, a rare species, survive drought.)

"You must be really sure what populations you can mix, and what you have to keep separate," Dalton says.

"Don't wait"

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The new study is also a reminder to keep an eye on other African species that might not currently seem in dire straits, says Philip Muruthi, vice president for species conservation at the African Wildlife Foundation in Nairobi, Kenya.

For instance, Muruthi is concerned that the plains zebra could follow in the footsteps of another emblematic African species, the giraffe.

Due largely to habitat loss and poaching, giraffes have experienced a 30 percent population decline over the past 30 years; the International Union for Conservation of Nature now considers the animal vulnerable to extinction. Yet the phenomenon is still so little known it's been dubbed a "silent extinction."

That's why the zebra study is crucial: By "highlighting the possibility that common species already have conservation issues," Muruthi says, "it's saying, Here is the issue. Don't wait."

[nationalgeographic.com](https://www.nationalgeographic.com), 21 January 2021

<https://www.nationalgeographic.com>

Engineers have built machines to scrub CO₂ from the air—and it could halt climate change

2021-01-26

On Wednesday this week, the concentration of carbon dioxide in the atmosphere was measured at 415 parts per million (ppm). The level is the highest in human history, and is growing each year.

Amid all the focus on emissions reduction, the Intergovernmental Panel on Climate Change (IPCC) says it will not be enough to avoid dangerous levels of global warming. The world must actively remove historical CO₂ already in the atmosphere – a process often described as "negative emissions."

CO₂ removal can be done in two ways. The first is by enhancing carbon storage in natural ecosystems, such as planting more forests or storing more carbon in soil. The second is by using direct air capture (DAC) technology that strips CO₂ from the ambient air, then either store it underground or turn it into products.

US research published last week suggested global warming could be slowed with an emergency deployment of a fleet of "CO₂ scrubbers" using DAC technology. However, a wartime level of funding from government

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and business would be needed. So is direct air capture worth the time and money?

What's DAC all about?

Direct air capture refers to any mechanical system capturing CO₂ from the atmosphere. Plants operating today use a liquid solvent or solid sorbent to separate CO₂ from other gases.

Swiss company Climeworks operates 15 direct air capture machines across Europe, comprising the world's first commercial DAC system. The operation is powered by renewable geothermal energy or energy produced by burning waste.

The machines use a fan to draw air into a "collector," inside which a selective filter captures CO₂. Once the filter is full, the collector is closed and the CO₂ is sequestered underground.

Canadian company Carbon Engineering uses giant fans to pull air into a tower-like structure. The air passes over a potassium hydroxide solution which chemically binds to the CO₂ molecules, and removes them from the air. The CO₂ is then concentrated, purified, and compressed.

Captured CO₂ can be injected into the ground to extract oil, in some cases helping to counteract the emissions produced by burning the oil.

The proponents of the Climeworks and Carbon Engineering technology say their projects are set for large-scale investment and deployment in coming years. Globally, the potential market value of DAC technology could reach US\$100bn by 2030, on some estimates.

Big challenges ahead

Direct air capture faces many hurdles and challenges before it can make a real dent in climate change.

DAC technology is currently expensive, relative to many alternative ways of capturing CO₂, but is expected to become cheaper as the technology scales up. The economic feasibility will be helped by the recent emergence of new carbon markets where negative emissions can be traded.

DAC machines process an enormous volume of air, and as such are very energy-intensive. In fact, research has suggested direct air capture machines could use a quarter of global energy in 2100. However new DAC methods being developed could cut the technology's energy use.

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While the challenges to direct air capture are great, the technology uses less land and water than other negative emissions technologies such as planting forests or storing CO₂ in soils or oceans.

DAC technology is also increasingly gaining the backing of big business. Microsoft, for example, last year included the technology in its carbon negative plan.

Opportunities for Australia

Australia is uniquely positioned to be a world leader in direct air capture. It boasts large areas of land not suitable for growing crops. It has ample sunlight, meaning there is great potential to host DAC facilities powered by solar energy. Australia also has some of the world's best sites in which to "sequester" or store carbon in underground reservoirs.

Direct air capture is a relatively new concept in Australia. Australian company Southern Green Gas, as well as the CSIRO, are developing solar-powered DAC technologies. The SGG project, with which I am involved, involves modular units potentially deployed in large numbers, including close to sites where captured CO₂ can be used in oil recovery or permanently stored.

If DAC technology can overcome its hurdles, the benefits will extend beyond tackling climate change. It would create a new manufacturing sector and potentially re-employ workers displaced by the decline of fossil fuels.

Looking ahead

The urgency of removing CO₂ from the atmosphere seems like an enormous challenge. But not acting will bring far greater challenges: more climate and weather extremes, irreversible damage to biodiversity and ecosystems, species extinction, and threats to health, food, water, and economic growth.

DAC technology undoubtedly faces stiff headwinds. But with the right policy incentives and market drivers, it may be one of a suite of measures that start reversing climate change.

thenextweb.com, 26 January 2021

<https://www.thenextweb.com>

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Diamond holds up at pressures more than five times those in Earth's core

2021-01-27

Diamond stands up to a squeeze. Surprisingly, the material's structure persists even when compressed to 2 trillion pascals, more than five times the pressure in Earth's core, scientists report January 27 in Nature.

The study suggests that diamond is metastable at high pressures: It retains its structure despite the fact that other, more stable structures are expected to dominate under such conditions. Studying diamond's quirks at extreme pressures could help reveal the inner workings of carbon-rich exoplanets (SN: 7/16/14).

Diamond is one of several varieties of carbon, each composed of a different arrangement of atoms. At everyday pressures on Earth's surface, carbon's most stable state is graphite. But given a forceful squeeze, diamond wins out. That's why diamonds form after carbon takes a plunge inside Earth.

But at higher pressures than those found inside Earth, scientists had predicted that new crystal structures would be more stable. So physicist Amy Lazicki and colleagues pummeled diamond with powerful lasers at Lawrence Livermore National Laboratory's National Ignition Facility in California. X-ray measurements of the material's structure revealed that diamond persisted, suggesting it is metastable under extreme pressure.

Diamond was already known to be metastable at low pressures: Your grandma's diamond ring hasn't morphed into graphite. Once formed, diamond's structure can persist even if the pressure drops, thanks to the strong chemical bonds that hold carbon atoms together in diamond. Now, says Lazicki, of Lawrence Livermore, "it looks like the same is true when you go to much higher pressure."

sciencenews.org, 27 January 2021

<https://www.sciencenews.org>

Some bacteria are suffocating sea stars, turning the animals to goo

2021-01-20

The mysterious culprit behind a deadly sea star disease is not an infection, as scientists once thought.

At everyday pressures on Earth's surface, carbon's most stable state is graphite. But given a forceful squeeze, diamond wins out.

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Instead, multiple types of bacteria living within millimeters of sea stars' skin deplete oxygen from the water and effectively suffocate the animals, researchers report January 6 in *Frontiers in Microbiology*. Such microbes thrive when there are high levels of organic matter in warm water and create a low oxygen environment that can make sea stars melt in a puddle of slime.

Sea star wasting disease — which causes lethal symptoms like decaying tissue and loss of limbs — first gained notoriety in 2013 when sea stars living off the U.S. Pacific Coast died in massive numbers. Outbreaks of the disease had also occurred before 2013, but never at such a large scale.

Scientists suspected that a virus or bacterium might be making sea stars sick. That hypothesis was supported in a 2014 study that found unhealthy animals may have been infected by a virus (SN: 11/19/14). But the link vanished when subsequent studies found no relationship between the virus and dying sea stars, leaving researchers perplexed (SN: 5/5/16).

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The new finding that a boom of nutrient-loving bacteria can drain oxygen from the water and cause wasting disease “challenges us to think that there might not always be a single pathogen or a smoking gun,” says Melissa Pespeni, a biologist at the University of Vermont in Burlington who was not involved in the work. Such a complex environmental scenario for killing sea stars “is a new kind of idea for [disease] transmission.”

There were certainly many red herrings during the hunt for why sea stars along North America's Pacific Coast were melting into goo, says Ian Hewson, a marine biologist at Cornell University. In addition to the original hypothesis of a viral cause for sea star wasting disease — which Hewson's team reported in 2014 in *Proceedings of the National Academy of Sciences* but later disproved — he and colleagues analyzed a range of other explanations, from differences in water temperature to exposing the animals to bacteria. But nothing reliably triggered wasting.

Then the researchers examined the types of bacteria living with healthy sea stars compared with those living among the animals with wasting disease. “That was when we had our aha moment,” says Hewson.

Types of bacteria known as copiotrophs, which thrive in environments with lots of nutrients, were present around the sea stars at higher levels than normal either shortly before the animals developed lesions or as they did so, Hewson and colleagues found. Bacterial species that survive

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only in environments with little to no oxygen were also thriving. In the lab, the sea stars began wasting when the researchers added phytoplankton or a common bacterial-growth ingredient to the warm water tubs those microbes and sea stars were living in.

Experimentally depleting oxygen from the water had a similar effect, causing lesions in 75 percent of the animals, while none succumbed in the control group. Sea stars breathe by diffusing oxygen over small external projections called skin gills, so the lack of oxygen in the wake of flourishing copiotrophs leaves sea stars struggling for air, the data show. It's unclear how the animals degrade in low oxygen conditions, but it could be due to massive cell death.

Although the disease isn't caused by a contagious pathogen, it is transmissible in the sense that dying sea stars generate more organic matter that spur bacteria to grow on healthy animals nearby. “It's a bit of a snowball effect,” Hewson says.

The team also analyzed tissues from sea stars that had succumbed in the 2013 mass die-off — which followed a large algal bloom on the U.S. West Coast — to see if such environmental conditions might explain that outbreak. In fast-growing appendages that help them move, the sea stars that perished had high amounts of a form of nitrogen found in low oxygen conditions — a sign that those animals may have died from a lack of oxygen.

The problem may get worse with climate change, Hewson says. “Warmer waters can't have as much oxygen [compared with colder water] just by physics alone.” Bacteria, including copiotrophs, also flourish in warm water.

But pinpointing the likely cause could help experts better treat sick sea stars in the lab, Hewson says. Some techniques include increasing the oxygen levels in a water tank to make the gas more easily available to sea stars or getting rid of extra organic matter with ultraviolet light or water exchange.

“There's still a lot to figure out with this disease, but I think [this new study] gets us a long way to understanding how it comes about,” Pespeni says.

[sciencenews.org](https://www.sciencenews.org), 20 January 2021

<https://www.sciencenews.org>

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Debate heats up over swimming ability of bizarre-looking Spinosaurus

2021-01-31

The wild-looking Spinosaurus may not have been the Michael Phelps of dinosaurs, as was recently claimed, but rather more like a casual bathing beauty that preferred to wade gracefully in the shallow zone, a new study suggests.

That's not to say Spinosaurus couldn't swim: It could. But it wasn't the "highly specialized aquatic predator" that could efficiently chase prey through the water, as it was made out to be in a big 2020 study published in the journal *Nature*, the researchers of the new study said.

"Spinosaurus was probably a decent swimmer, and certainly a better swimmer than any other known large theropod [bipedal, mostly meat-eating dinosaurs]," study co-researcher Thomas Holtz, principal lecturer in vertebrate paleontology at the University of Maryland, told *Live Science* in an email. "But being a swimmer isn't the same thing as being a specialized aquatic pursuit predator."

Rather, Spinosaurus was probably like a modern-day heron or stork — wading into the water and sticking part of its head underwater as it fished for prey, but also opportunistically hunting on land for terrestrial animals or winged creatures, the researchers said.

SOUND

Spinosaurus, which lived about 112 million to 94 million years ago during the Cretaceous period, has baffled scientists since its 1915 discovery in North Africa. At more than 50 feet (15 meters) in length, it was as large as a *Tyrannosaurus rex* and had large projections sticking out of its back, which may have formed a skin-covered sail. The oddball's crocodile-like snout and teeth indicated that it hunted fish; chemical analyses of isotopes (versions of an element) and fossil finds confirmed it ate fish as well as snacked on dinosaurs and pterosaurs.

Spinosaurus' habits are challenging to decipher because there are few fossils of the beast. The most complete skeleton, from Egypt, was destroyed in 1944 when the Allies bombed a museum in Munich, Germany. In the past decade or so, new fossil discoveries have led to a slew of studies on Spinosaurus, triggering renewed interest in understanding its lifestyle, said Darla Zelenitsky, an assistant professor of paleontology at the University of Calgary, who was not involved in the study.

"But being a swimmer isn't the same thing as being a specialized aquatic pursuit predator."

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Champion or mediocre swimmer?

The researchers took a deep dive into Spinosaurus' anatomy, habitat and diet, and also compared these with the features of other animals, both living and extinct.

So, what about Spinosaurus negates the "Olympic swimmer" claim? The new analysis suggested its weird body shape, especially its tall sail, would have created a lot of drag in the water. "Our rough estimate shows it would [have needed] to be many meters under the water to reduce the drag effect," Holtz said. "But as Spinosaurus is known from estuarine [swampy] environments, it was feeding not just in huge Mississippi- or Amazon-like channels, but in water of all depths."

Moreover, Spinosaurus' body shape didn't look like that of other aquatic pursuit hunters.

"Most larger pursuit predators — from Jurassic ichthyosaurs to tunas to dolphins and so on — have relatively stiff bodies and short necks, with the propulsion generated from a rather concentrated area of motion in the tail," Holtz said. But Spinosaurus didn't have a short neck or a stiff body. "In contrast, the body of Spinosaurus is more like less specialized swimmers. And the fact that isotopic evidence shows they were also feeding on land strongly supports them as having a more generalized lifestyle rather than one committed to a single primary mode of life," Holtz said.

Spinosaurus had a relatively long neck that was curved like a coat hanger. "It's got this weird neck ... for stabbing down," added study lead researcher David Hone, a senior lecturer of zoology at Queen Mary University of London. Plus, its nostrils were halfway up its snout, not on top of its snout like a crocodile's. "That makes sense if you hold your nose just under the surface [while hunting]," rather than spending all its time mostly submerged, Hone told *Live Science*.

Other anatomical clues hint that Spinosaurus was more like a stork than a leviathan — Hone detailed many on Twitter, including that propulsion from long tails, like that of Spinosaurus, usually helps with short bursts, not lengthy pursuits, Hone said. The 2020 *Nature* study also showed that Spinosaurus couldn't swim as efficiently as a crocodile, in part because it had fewer tail muscles than crocs.

Perhaps, Spinosaurus' tail had other purposes besides swimming — it could have been a dinosaur-age billboard, for example, used to send social-sexual signals, the researchers said. For instance, an elephant uses

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its tusks for many purposes, such as attracting mates, defending itself, digging and lifting objects, they said.

But other paleontologists say that more research on Spinosaurus is needed to suss out its past. "Both studies have their merits, and I suspect that this is not the end of the lifestyle controversy for Spinosaurus," Zelenitsky said.

"So what's next for Spinosaurus? Who knows?" Lindsay Zanno, head of paleontology at North Carolina Museum of Natural Sciences and associate research professor at North Carolina State University, who was not involved in the study, told Live Science in an email. "But if it were me, I'd look more closely at the internal structure of the skeleton." The microscopic structure of the bone could reveal whether it floated well, Zanno noted.

Meanwhile, the lead author of the 2020 study is standing by his interpretation that Spinosaurus was a specialized predator of aquatic prey. "Long story short, it doesn't really change anything for us — there is nothing in the paper we have not considered before," Nizar Ibrahim, a senior lecturer of paleontology at the University of Portsmouth in the United Kingdom, told Live Science in an email.

The new study was published in the January issue of the journal *Palaeontologia Electronica*.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 31 January 2021

<https://www.livescience.com>

A robot arm toting a Venus flytrap can grab delicate objects

2021-01-25

A new robotic grabber is ripped straight from the plant world. The device, made with a severed piece of a Venus flytrap, can grasp tiny, delicate objects, researchers report January 25 in *Nature Electronics*.

Normally, the carnivorous *Dionaea muscipula* scores a meal when unsuspecting prey touches delicate hairs on one of the plant's jawlike leaves, triggering the trap to snap shut (SN: 10/14/20). But by sticking electrodes to the leaves and applying a small electric voltage, researchers designed a method to force Venus flytraps to close. Even when cut from the plant, the leaves retained the ability to shut upon command for up

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to a day, say materials scientist Wenlong Li and colleagues at Nanyang Technological University in Singapore.

Integrating soft, flexible plant material into robotics could aid in picking up fragile objects that would otherwise be damaged by clunky, rigid graspers, the researchers say. So, Li's team attached a piece of a flytrap to a robotic arm and used a smartphone app to control the trap. In experiments, the robotic grabber clutched a piece of wire one-half of a millimeter in diameter. And when not strapped to the robotic arm, the dismembered plant also caught a slowly moving 1-gram weight.

One drawback: The traps take hours to reopen, meaning this bot had better make the catch on the first try.

[sciencenews.org](https://www.sciencenews.org), 25 January 2021

<https://www.sciencemag.org>

A new orange and black bat species is always ready for Halloween

2021-01-25

Bats, better known for their mousy looks, can have a colorful side. A new species, discovered when two bats were caught at an abandoned miners' tunnel in western Africa, sports showy swathes of orange fur.

The new finds "are just gorgeous," says mammalogist Nancy Simmons of the American Museum of Natural History in New York City. Orange fur on the bats' backs contrasts with black sections of wing membranes.

But that's not what sets this bat apart: Three other *Myotis* species from the continent are similarly flashy. Rather less visible traits, from details of hidden striping in its fur to its echolocation calls, peg *Myotis nimbaensis* as something unusual, Simmons and colleagues report online January 13 in *American Museum Novitates*.

The new species was discovered the old-fashioned way — out in a remote forest at night with keen eyes studying real animals. That's not so common nowadays in the age of sensitive genetic tools, Simmons says. Many of the 20 or so new bat species typically named every year are detected through genetic analyses of museum specimen lookalikes. *M. nimbaensis* differs genetically from near kin — about as much as humans differ from gorillas. Differences also show up in teeth as well as other anatomy.

Bottom of Form

Orange fur on the bats' backs contrasts with black sections of wing membranes.

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But when researchers collected the first bat, near the mouth of an abandoned tunnel for mineral exploration up in Guinea's section of the Nimba Mountains, the flashy beast wasn't obviously anything new. While most of the more than 1,400 known kinds of bats are various shades of brown, bats here and there around the world can be yellow, fluffball white or coppery red. And there was the matter of the three other orange *Myotis* species. (How, or whether, the colors matter in animals active at night, Simmons says, is "one of the mysteries.")

One way to tell the new species apart is from the proportions of secret stripes on the individual hairs in orange fur patches. In the newly named bats, the bottom third of each orange hair is black. Then comes a creamy white middle third before the hair turns pumpkin at the tip.

Researchers named *M. nimbaensis* after its mountainous habitat. The Nimba Mountains shoot up abruptly from lowland forests, creating little "sky islands" of isolated habitat on peaks, says coauthor Eric Moïse Bakwo Fils, a bat specialist at the University of Maroua in Cameroon. *M. nimbaensis* probably eats insects, judging by its interlocking triangular teeth.

Bakwo Fils worries about the fragility of sky islands and the newfound bats' future. Small animals flitting in the dark rarely get the conservation attention that large charismatic African wildlife does. Yet we depend on various little half-seen bats streaking in the dark to catch insects, pollinate plants, spread seeds and help with other chores that keep our ecosystems going.

sciencenews.org, 25 January 2021

<https://www.sciencenews.org>

How many people are in the world?

2021-01-26

There are approximately 7.8 billion people in the world as of July 2020, according to a 2020 report published in the journal *The Lancet*.

The global population is an estimate of the total number of people living on the planet, rather than a true running total of every baby born minus every person who has died at a given moment in time.

Because it's impossible to keep track of the real-time numbers of births and deaths worldwide, demographers, or statisticians that study human populations, calculate the world's population by adding up estimates of

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regional populations, according to the United Nations. They arrive at these regional estimates by taking into account a variety of factors, including fertility rate, or the average number of children that a woman has in her lifetime, and mortality rate, or a person's life expectancy, given the social and economic conditions of the region.

PLAY SOUND

The world's population has grown rapidly in the last two centuries, driven largely by an increase in the number of people surviving to reproductive age as quality of life and healthcare have improved in almost every country around the world over this time. However, ever since peaking in the 1970's, the global population growth rate has slowed, according to a 1993 report published in the journal *Population Today*.

The world's population reached 1 billion a little more than 200 years ago, in 1800, according to *Our World in Data*, an open-source database and charity based in England and Wales. The rate of growth quickly accelerated in the years that followed. The next billion came a little over one century later, in 1927. The global population hit 3 billion in 1959, 4 billion in 1975, 5 billion in 1987 and 6 billion in 1999, according to the United Nations. There were an estimated 7 billion people in the world as of Oct. 31, 2011 and that number is projected to reach 8 billion in 2023, 9 billion in 2037 and 10 billion by 2057, according to the same United Nations data.

The U.N. projects that the world's population will reach about 11 billion by 2100, though long-term future projections are subject to change. In 2019, a report published by the United Nations predicted that the global population annual growth rate would fall to less than 0.1% by 2100, due to a decreasing number of children born worldwide.

Over the last 50 years, the composition of the world population, or the number of people in various demographic categories such as nationality, ethnicity and age, has changed because the nature of population growth isn't uniform across the regions of the world. Populations in certain areas are growing more quickly than others due to differences in fertility and mortality rates, as well as differing patterns of migration.

In general, demographers have identified four demographic "mega-trends" that can help explain these changes in the composition of the global population: overall population growth, aging, increasing international migration and urbanization. These are overarching themes that broadly point to how and why the global population will change in the coming years.

However, ever since peaking in the 1970's, the global population growth rate has slowed, according to a 1993 report published in the journal *Population Today*

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The history of global population growth over time

For the vast majority of human history, the global population grew relatively slowly. Historical demographers have estimated that about 4 million people lived on Earth in 10,000 B.C., according to Our World in Data. That number grew to about 190 million people at the dawn of the first millennia, at A.D. 0. The population continued to rise from then on, though it might have either stayed the same or declined during the Black Death, when the Bubonic Plague struck Europe and killed between 33% and 55% of the population in the 1300s.

The average annual population growth rate was 0.04% annually from 10,000 B.C. to A.D. 1700, according to Our World in Data. By 1800, there were approximately 1 billion people living in the world, per the same source. The Industrial Revolution at the turn of the century spurred an acceleration in the global population growth rate that lasted for the next 100 years, leading up to the world's two-billionth human being born in 1927.

From 1920 to 1950, the population growth rate averaged around 1% a year, according to Our World in Data. By the middle of the century, advances in public health, especially the discovery of antibiotics, increased the average life expectancy, and the number of people on the planet surged.

Thirty-three years after the global population hit 2 billion, in 1960, the global population hit 3 billion. The growth rate during the last half of the 1960s hit an all-time peak, averaging 2.04% a year, according to a 1998 study published in the journal *Medicine & Global Survival*.

Population growth exploded in the later half of the 20th century due to a number of reasons, including a widespread decline in mortality, especially among children, said Sara Hertog, a demographer with the United Nations. "And of course, improved survival of children means more adults a couple of decades later who have more children for the next generation," Hertog told *Live Science*. "Also, the post-war baby boom [beginning in late 1940s] led to population growth in North America and Europe in particular."

By the 1970s, the popularization of contraception helped slow population growth once again. But because so many humans were already on the planet, a so-called "population explosion" was beginning to take place, and the global population reached 4 billion in 1974. In 1987, just 13 years later, there were 5 billion people. And just 12 years after that, in 1999, there were 6 billion. Another 12 years later, in 2011, there were 7 billion, and

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it's projected that it will take another 12 years to reach 8 billion in 2023, according to United Nations' estimates.

However, the rate of global population growth has slowed considerably since the population explosion of the 1970s. It's currently about 1.05% as of 2020, according to Worldometer, an independent open-source database. The growth rate was 1.08% in 2019, 1.10% in 2018, and 1.12% in 2017, according to Worldometer, which uses United Nations' population data for these calculations.

Breaking global population growth down by region shows that the declining growth rate trend is not taking place everywhere. For example, the population growth rate is about 2.7% in Sub-Saharan Africa as of 2020, according to the *Economist*. This is where demographers expect over half of the world's population to grow over the next century, largely due to high fertility rates and decreasing mortality rates there.

The fertility rate and global population

The fertility rate is one of the most important numbers that's used to estimate the global population. The total fertility rate of a population is the average number of offspring per woman and because it's an average, it's calculated to the tenth decimal point. If the fertility rate increases while other factors for population remain the same, the population will grow.

A fertility rate of 2.1 children per woman is known as the replacement fertility rate. It means that a population will neither decline nor grow. This is because on average, if women each give birth to 2.1 children that survive to at least age 15, these children will replace the mother and her partner in the next generation, according to the *encyclopedia Britannica*.

The global average fertility rate is 2.5 as of 2015, according to the United Nations. (This is a significant decrease from an average of 3.2 births per woman in 1990.) But fertility rates around the world vary widely depending on the specific region. The total fertility rate in Sub-Saharan Africa is 4.6, for example, while in North America and Europe it's 1.7.

"There are a number of factors that influence the fertility rate of a given country," Hertog said. "Most notably, the level of human development and the women's access to education and employment opportunities, and access to information and resources for family planning that enables them to decide on the timing and number of their children."

Several studies have shown that when women and girls have the same educational opportunities as their male peers, women have more

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opportunities later in life and tend to have fewer children. This could be due to the fact that women may choose to delay having children when they pursue education and gainful employment.

In addition, urbanization tends to lead to lower fertility rates. Urban areas typically undergo a “demographic transition” — a shift from high birth and death rates, to low birth and death rates.

However, lower birth and death rates in urban areas isn’t a guarantee, “given that the quality of healthcare and sanitation is not universally better in urban areas, specifically, for example, in slum conditions,” Hertog said. “But one thing that happens in urban areas that affects fertility and thus, population growth, is that women tend to have more access to education, employment opportunities and reproductive healthcare.”

Mortality and the global population

Mortality refers to the measure of the number of deaths in a population. This data is usually obtained from countries’ death registers.

It can be difficult for demographers to get an exact number of deaths in a population over a given time, because not every country maintains national birth and death databases or conducts a census registering all births and deaths. If this is the case, demographers can estimate the number of deaths in a population based on surveys. They use this number along with factors such as life expectancy and other demographic factors including gender to calculate the rate of mortality. (Life expectancy is estimated based on poverty rates, health quality, especially prevalence of infectious diseases, for a given year.)

According to Our World in Data, historical demographers have estimated that life expectancy was around 30 years in all regions of the world before industrialization, which began in Europe around 1800. There were high rates of infant and youth (those under the age of 15) mortality, with about 27% of all children dying before the age of 1 and about 47% of all children dying before the age of 15, according to a 2013 study published in the journal *Evolution and Human Behavior*. The global fertility rate was 5.77, according to economist Mattias Lindgren at global development foundation Gapminder, though the rate ranged by country. In the United States, it was 7, while in Norway, it was 4.3.

But infant, youth and adult mortality have decreased around the world, bringing the life expectancy up, largely due to advances in food

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production, medicine and sanitation, according to a 2013 report published in *The Lancet*.

The average global life expectancy improved from 46.5 years between 1950 - 1955 to 65 years between 1995 - 2000, according to the World Health Organization. As of 2019, the United Nations estimated a global average life expectancy of 72.6 years.

Still, life expectancy varies around the world. Global life expectancy in 2016 was 72 years on average, but that ranged from about 61.2 years throughout Africa to 77.5 years in Europe, according to the World Health Organization.

Studies have shown that there is a correlation between a low standard of living, which accompanies higher levels of poverty, and lower life expectancies. In addition, major events such as wars, natural disasters, famines and pandemics can have a significant impact on the overall mortality of a population.

PLAY SOUND

How demographers find data to reach these calculations

Demographers rely upon countries’ vital statistics and censuses to gather data on the number of births, deaths, emigration and immigration that take place within each country. However, not all countries keep these records, and even when they do, the records aren’t always accurate. Many developing countries, countries that are experiencing conflicts or areas where natural disasters have caused mass human displacement do not have available data.

If country-wide data are not available demographers rely on household surveys, Hertog said. These surveys sample a representative number of households in a country. An interviewer visits each of those households and interviews household members, asking key questions about their characteristics such as age of household members, education level, income, household situation and births and deaths in their family.

Demographers will then use the data collected in their surveys to extrapolate fertility and mortality for the country’s population. This data goes into making the projections of the global population in the coming years.

Projections of the future global population

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Population projections attempt to show how many people will live on the planet in the near future and in the long-term. The projections of future global populations are not definite, given that the conditions determining how many children will be born and how many people will die are constantly changing.

A 2019 United Nations report found that nine countries will contribute more than half of all projected global population growth by 2050: India, Nigeria, Pakistan, the Democratic Republic of the Congo, Ethiopia, the United Republic of Tanzania, Indonesia, Egypt and the U.S. (in descending order of projected growth).

Having accurate projections of the global population is important for understanding how people will use the finite resources of the planet. In addition, understanding the population distribution is crucial to understand how to best allocate resources.

For example, predicting how many children will be born, and where, can help determine where resources for healthcare and education should be directed. And predicting the number of people entering an area's workforce can help countries figure out how to establish the most efficient labor markets.

[livescience.com](https://www.livescience.com), 26 January 2021

<https://www.livescience.com>

How do wombats poop cubes? Scientists get to the bottom of the mystery?

2021-01-27

Humans may be fascinated by cubes, but only one animal poops them: the bare-nosed wombat. This furry Australian marsupial squeezes out nearly 100 six-sided turds every day—an ability that has long mystified scientists. Now, researchers say they have uncovered how the wombat intestine creates this exceptional excrement.

"This study is really good," says Sunghwan Jung, a biophysicist at Cornell University who studies the mechanics of animal movements and was not involved with the research. It shows, he says, that the guts of these animals "are very special."

The bare-nosed wombat (*Vombatus ursinus*), which weighs up to 35 kilograms, lives in the grassy plains and eucalyptus forests of Australia, where it spends its nights grazing on plants and its days in underground

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tunnels. It's a territorial animal, leaving its unusual droppings as a calling card. But how does such sharp-sided scat come from a round anus?

To get to the bottom of the mystery, scientists dissected a wombat that had died after being hit by a car. They examined the intestines and found that they contain two grooves where the guts are more elastic, which the team first reported in 2018.

In the new study, the researchers dissected two further wombats and tested the guts' layers of muscle and tissue, finding regions of varied thickness and stiffness. They then created a 2D mathematical model to simulate how the regions expand and contract with the rhythms of digestion. The intestinal sections contract over several days, squeezing the poop as the gut pulls nutrients and water out of the feces, the team reports today in the aptly titled journal *Soft Matter*.

The stiffer portions are "like a stiff rubber band—[they're] going to contract faster than the soft regions," says David Hu, a biomechanics researcher at the Georgia Institute of Technology and author on the study. Softer intestinal regions squeeze slowly and mold the final corners of the cube, the team found. In other mammals, the wavelike peristalsis of the intestinal muscles are consistent in all directions. But in the wombat, the grooved tissue and the irregular contractions over many cycles shape firm, flat-sided cubes.

That just leaves one mystery: why wombats evolved cubic poop in the first place. Hu speculates that because the animals climb up on rocks and logs to mark their territory, the flat-sided feces aren't as likely to roll off from these high perches.

As for what the world is supposed to do with this new information, Hu admits that it's "not going to replace the way we manufacture plastic." But the wombat's strategy could help engineers design better ways to shape valuable or sensitive materials, he says.

In the meantime, Hu also thinks this knowledge could help researchers raising wombats in captivity. "Sometimes their feces aren't as cubic as the [wild] ones," he says. The squarer the poop, the healthier the wombat.

[scienemag.org](https://www.livescience.org), 27 January 2021

<https://www.livescience.org>

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Spitting cobras' venom evolved to inflict pain

2021-01-21

Spitting cobras protect themselves by shooting jets of venom into the eyes of their attackers. A new study suggests that over the course of several million years, all three groups of spitters independently tailored the chemistry of their toxins in the same way to cause pain to a would-be predator. The work provides a novel example of convergent evolution that “deepens our understanding of this unique system” for delivering venom, says Timothy Jackson, an evolutionary toxinologist at the University of Melbourne.

Like other cobras, spitting cobras will bite attackers in self-defense. Spitting is their signature move, however, and the snakes are crack shots. They can direct a stream of venom into an attacker’s face from more than 2 meters away, aiming for the eyes. The behavior is such a formidable defense that it evolved independently three times: in Asian cobras, African cobras, and a cobra cousin called the rinkhals (*Hemachatus haemachatus*) that lives in southern Africa.

Scientists previously found the venom of some other snakes evolved to better subdue their prey. By analyzing the venoms of 17 spitting and nonspitting species—and measuring their effects—venom biologist Nicholas Casewell of the Liverpool School of Tropical Medicine and colleagues tested whether the makeup of spitting cobra venom had also changed over time to become a more effective defense.

The most common compounds in cobra venom are the so-called three-finger toxins—proteins named for their 3D chemical shape, not the number of digits you can expect to lose if a snake bites your hand. Three-finger toxins are equally abundant in the venom of spitters and nonspitters, Casewell and colleagues found, constituting about 60% of the toxic molecules. However, the spitting species’ venom contained higher levels of another group of proteins known as phospholipase A2 toxins, which nonspitters produce only in small quantities, or not at all.

To probe the effects of the extra phospholipase A2 proteins, the scientists dabbed different combinations of toxins from the snakes onto isolated mouse nerves that are sensitive to pain. The more neurons a toxin stimulates, the more pain would result. The researchers determined the three-finger toxins triggered more pain when combined with phospholipase A2 toxins than alone. For instance, when the researchers applied both kinds of toxins from rinkhals venom to mouse nerves, the

Like other cobras, spitting cobras will bite attackers in self-defense.

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mix stimulated about twice as many nerve cells as the rinkhals’ three-finger toxins alone, they report today in *Science*.

The work suggests natural selection fine-tuned the composition of the snakes’ venom to make it a better defense, Casewell says. That the three groups of spitters independently derived the same solution—increased abundance of phospholipase A2 toxins—is an example of convergent evolution, in which species that aren’t closely related but face similar survival challenges acquire similar adaptations. “Evolution can be highly repeatable,” Casewell says.

The study’s evolutionary logic makes sense, says toxinologist Stephen Mackessy of the University of Northern Colorado, Greeley, who wasn’t connected to the research. Increasing the venom’s agony-inducing power would help the snakes ward off predators because “one of the best learning tools is production of pain,” he says. But Joe Alcock, an evolutionary medicine researcher at the University of New Mexico, Albuquerque, says it’s possible that damaging an attacker’s eyes was the driving force to evolve unique chemistry. “If you can blind a predator, that would prevent an attack independent of pain,” he says.

Why some cobras began to spray venom rather than just deliver it through bites remains unclear. Some researchers argue the behavior protects the snakes from being stomped on by hoofed mammals. But the side-facing eyes of buffalos, zebras, and other heavy-footed mammals would be hard to hit with a single jet of venom, Casewell notes. Instead, he and his colleagues postulate that early humans motivated the origin of spitting behavior. Our ancestors would have been a menace to the snakes, and they conveniently had forward-facing eyes that would make good targets for a stream of noxious venom.

sciencemag.org, 21 January 2021

<https://www.sciencemag.org>

Why cats and dogs may need their own COVID-19 vaccines

2021-01-26

Cats and dogs may eventually need their own COVID-19 vaccines to prevent the coronavirus from evolving further and “spilling” back to humans, according to one group of researchers.

Then, the strains could “spill back into the human population and you end up essentially with a new virus which is related, which causes the whole thing all over again.”

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SARS-CoV-2, the virus that causes COVID-19, is known to infect a number of animals besides humans, including cats, dogs, minks, tigers and gorillas. However, at this time, scientists don't think animals play a significant role in spreading the virus to people, and reports of COVID-19 in pets are rare, according to the Centers for Disease Control and Prevention (CDC).

Still, the authors of a new editorial, published Jan. 25 in the journal *Virulence*, say that these animal "reservoirs" may pose a risk to humans down the road, because there is the potential for the virus to evolve in those species and spread back to people.

"The risk is that, as long as there are these reservoirs, that it starts to pass ... from animal to animal, and then starts to evolve animal-specific strains," Kevin Tyler, editor-in-chief of *Virulence* and co-author of the editorial, told the wire service PA Media. Then, the strains could "spill back into the human population and you end up essentially with a new virus which is related, which causes the whole thing all over again."

As such, "it is not unthinkable that vaccination of some domesticated animal species might also be necessary to curb the spread of the infection," the authors wrote in the editorial.

However, the authors are not calling for vaccinating dogs and cats against COVID-19 right now, but instead proposing the idea to be considered in the future.

"It is important to stress that we are not seeing onward transmission in cats (or dogs) at the moment and there is no need for owners to consider vaccinating [their pets] right now, but we should be prepared for that as a possibility at some stage," Tyler told Live Science in an email.

Indeed, the U.S. Department of Agriculture (USDA) is not currently granting approvals for licenses for COVID-19 pet vaccines, because at this time, "data do not indicate such a vaccine would have value," according to *Science* magazine. "Companies are still free to do research and development on these vaccines ... but without a license, they can't sell or distribute them," USDA spokesperson Joelle Hayden told *Science*.

But COVID-19 vaccines for minks — which have caught the disease in large numbers on mink farms and spread it back to humans in some cases — are another story. The USDA is accepting license applications for COVID vaccines for minks, and researchers in the U.S. and Russia are currently developing vaccines for minks, according to *The New York Times*.

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More broadly, the new editorial calls for the continued use of strict health and safety measures to reduce the transmission and evolution of new SARS-CoV-2 variants.

"Continuing public health efforts to encourage vaccination as well as continued use of proper personal protective equipment (PPE), such as proper masking and maintaining safe social interactions, is of utmost importance," they said. **PLAY SOUND**

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[livescience.com](https://www.livescience.com), 26 January 2021

<https://www.livescience.com>

China says COVID-19 anal test more accurate than nose or throat method

2021-01-28

We've faced so many indignities over the last year due to COVID-19. China now says that a COVID-19 anal test is more accurate than throat or nose swabs. Might we soon need an anal test in order to travel?

COVID-19 Anal Test

China has introduced a new COVID-19 testing protocol for those in quarantine. The test requires inserting a cotton swab three to five centimeters (one to two inches) into the rectum, then rotating it multiple times.

With COVID-19 cases rising in Beijing last week, doctors have heralded the new testing method on state TV, noting it will be helpful in controlling cases ahead of the high risk Lunar New Year, a period in which millions of Chinese traditionally travel. Beijing city officials noted that anal swabs were taken from more than 1,000 teachers, staffers, and students at a primary school last week after a coronavirus outbreak in which many tested positive.

The controversy is not settled though. In recent days, the *Global Times*, a state-run news outlet, noted that the procedure remains controversial, with some doctors arguing nasal and throat swabs were more effective because coronavirus is a respiratory tract infection.

"If we add anal swab testing, it can raise our rate of identifying infected patients," Li Tongzeng, an infectious-disease specialist at Beijing You'an

Might we soon need an anal test in order to travel?

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Hospital, said on state-run broadcaster CCTV on Sunday. "But of course, considering that collecting anal swabs is not as convenient as throat swabs, at the moment only key groups such as those in quarantine receive both."

But a study recently published in China supports the theory that anal swabs are more effective:

"Intriguingly, SARS-CoV-2 detection was positive in the anal swab of two patients and negative in throat swab and sputum samples... We propose anal swabs as the potentially optimal specimen for SARS-CoV-2 detection for evaluation of hospital discharge of covid-19 patients."

Will We See This In The USA Too?

With Chinese authorities now making anal COVID-19 testing mandatory, can we expect the same in the United States? Might this become a travel requirement?

Just because virus traces may remain longer in the anus than in the respiratory tract does not mean that anal testing is better for gauging transmissibility of the disease. There are also no test results to suggest that COVID-19 can be spread via the human digestive system.

CONCLUSION

With mass testing and the effectiveness of rapid antigen testing already concerns, China has begun using COVID-19 anal testing. Scientists disagree on the effectiveness of such testing, but it could soon be another tool around the world to diagnose illness.

As one person noted, "For a year, COVID has been giving it to us up the a\$\$\$. Now, you can test for it there..."

liveandletsfly.com, 28 January 2021

<https://www.liveandletsfly.com>

Humans were drinking milk before they could digest it

2021-01-27

Our history with milk presents a chicken-or-egg conundrum: Humans couldn't digest the beverage before they evolved mutations that helped them do so, yet they had to already be consuming milk to change their DNA. "There's always been the question of which came first," says

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University of Pennsylvania geneticist Sarah Tishkoff. "The cultural practice or the mutation."

Now, scientists have found some of the oldest evidence yet for dairy drinking: People in modern Kenya and Sudan were ingesting milk products beginning at least 6000 years ago. That's before humans evolved the "milk gene," suggesting we were drinking the liquid before we had the genetic tools to properly digest it.

All humans can digest milk in infancy. But the ability to do so as an adult developed fairly recently, likely in the past 6000 years. A handful of mutations allows adults to produce the enzyme lactase, which can break down the milk sugar lactose. Genes that enable what's called lactase persistence are widespread in modern Africa, which has four known lactase persistence mutations. (European populations rely on just one.)

When these lactase mutations evolved, they spread rapidly—evidence that people who carried them had a big advantage. "It's one of the strongest signals of natural selection ever observed," says Tishkoff, who was not involved with the study.

To peer into our milk-drinking past, researchers turned to Africa, where societies have herded domesticated cows, sheep, and goats for at least 8000 years. The scientists examined eight skeletons excavated in Sudan and Kenya, which were between 2000 and 6000 years old. They scraped hardened dental calculus from their teeth and looked for known milk-specific proteins trapped inside.

The findings revealed these people were consuming some sort of dairy product at least 6000 years ago, the team reports today in *Nature Communications*. That makes this the earliest known direct evidence for dairy consumption in Africa, and perhaps the world.

The research also shows dairying in Africa goes back just as far as it does in Europe—perhaps longer. That undercuts a myth, propagated by white supremacists, that lactase persistence and milk drinking are somehow associated with white Europeans.

What's more, ancient Africans don't appear to have evolved any milk digesting genes, according to a study of some of their skeletal DNA published in 2020. "It looks like the community was drinking milk before they had lactase persistence," says Madeleine Bleasdale, a co-author of the new work and a specialist in ancient proteins at the Max Planck Institute for the Science of Human History.

"There's always been the question of which came first," says University of Pennsylvania geneticist Sarah Tishkoff. "The cultural practice or the mutation."

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The proteins could have come from milk, cheese, or fermented milk products like yogurt, which are common in Africa today. Fermentation is a strategy some cultures use to break down milk sugars before consuming them, which may make it easier for people without the adaptation to consume milk products without drinking raw milk.

The mutations may have eventually arisen because they helped people get more nutrients from their milk, giving them a leg up over their comrades, says Fiona Marshall, an archaeologist at Washington University in St. Louis who was not involved in the study. "Among those people, any individuals with lactase persistence would live longer and have more children."

The selection pressure for lactase persistence might also have been environmental. Milking is a sustainable way to manage herds under tough conditions, allowing herders to get nutrition from their animals without killing them. During droughts, for example, lactase persistent herders could make better use of cattle and goats as four-legged water filters and storage containers. "If you have cows, you have a source of liquid and proteins and nutrition," Tishkoff says. "As long as you can keep your cattle alive, of course."

sciencemag.org, 27 January 2021

<https://www.sciencemag.org>

What might Earth's next supercontinent look like? New study provides clues

2021-01-21

From Columbia to Rodinia to Pangaea, Earth has seen a few supercontinents come and go in its ancient past. Now, researchers theorize that these giant landmasses form in regular cycles, about once every 600 million years. They even predict when and where the next supercontinent will form, driven by the creeping flow of rocks in our planet's hot mantle.

"It's not an entirely surprising idea, but I like the way it's put together," says Paul Hoffman, a geologist and supercontinent expert at Harvard University who was not involved with the work.

Continents sit on tectonic plates—slabs of crust that float on the mantle. The mantle acts like a boiling pot of water: Earth's molten core heats the rock at the bottom of the mantle, causing it to slowly rise. Meanwhile, cooling slabs of crust sink in subduction zones to the bottom of the

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mantle. This circular flow is called mantle convection, and over millions of years it drives the motions of continental plates—and their occasional assembly into supercontinents.

To uncover more about Earth's supercontinent cycle, Ross Mitchell, a geologist at the Chinese Academy of Sciences, and his colleagues focused on "megacontinents," which are smaller than a full supercontinent. One such megacontinent is Gondwana, which formed about 520 million years ago and led to the assembly of Pangaea 200 million years later.

To study how Gondwana became Pangaea, the researchers mapped the continental plates over time, based on fossils and other deep-time records. And they explored how the position of these continents related to models of mantle flow—and the expected location of ancient upwellings and downwellings.

They found continents tend to drift "downhill" toward subduction zones where mantle rocks are cooling and sinking down. Mitchell calls these zones "subduction girdles," because the continental plates, too thick to subduct, go there and "get stuck," he says. They can only move laterally along this girdle and collect more continents, a process seen as Gondwana became Pangaea, the team reported in November 2020 in *Geology*.

Their model also predicts what's next for our planet. When Pangaea broke up 175 million years ago, it led to the formation of the Ring of Fire, a set of subduction zones along the perimeter of the Pacific Ocean that fuels volcanoes and earthquakes. Several continents have already combined to create the current megacontinent, Eurasia, and it has run up against the Ring of Fire, the subduction girdle of our age. As Eurasia moves laterally along the Ring of Fire, it will eventually collide with the Americas, forming a new supercontinent in the next 50 million to 200 million years, Mitchell says.

Geologists have named this next supercontinent "Amasia." Although there is much debate on where Amasia will end up, Mitchell's model suggests it will likely be polar, centered on today's Arctic Ocean.

"We can see that there's a sort of rhythm to the Earth's evolution," says Damian Nance, a geologist at Ohio University and expert on supercontinent evolution. "The jury's still out" on whether Mitchell has

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Curiosities

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solved the exact rhythm, he says, but “the pendulum is swinging towards [his] model.”

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