

# Bulletin Board

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JUN. 11, 2021

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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

#### Glyphosate: Call for information

2021-05-31

We are calling for information on the use of the weed killer glyphosate in Aotearoa New Zealand. This request for information is the very first step in deciding whether to change the rules around its use.

##### About glyphosate

- A weed killer used in New Zealand since the 1970s.
- It is common and is the active ingredient in many consumer and agricultural products.
- Used by home gardeners, farmers, and councils.
- It is safe to use if you follow the instructions and the rules.

Read more about glyphosate

New Zealand EPA, 31 May 2021

<https://www.epa.govt.nz/public-consultations/open-consultations/glyphosate-call-for-information/>

#### Agrichemicals and tea tree oil amongst chemical classification updates

2021-05-27

The hazard classifications of 123 substances have been updated as part of the latest Chemical Review by the Environmental Protection Authority (EPA).

We regulate agrichemicals, household chemicals and other dangerous goods and substances under the Hazardous Substances and New Organisms Act. As well as evaluating and approving substances, we can reassess and make decisions about whether the hazard classifications and controls (or rules of use) need updating.

New information such as study data, and reviews or assessments by overseas chemical regulators, have prompted hazard classification updates for these 123 substances – including single chemicals and mixtures.

We have updated the hazard classification of two agrichemicals, pymetrozine and chlorpropham, to reflect their cancer-causing

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properties. The changes will translate to clearer labelling guidance for the professionals who use the substances.

Metamitron, a herbicide used by farmers, is less toxic than previously thought, so has had some of its hazard classifications downgraded or removed.

Tea tree oil, which can cause skin and eye irritation, will now have a warning listed on how toxic it is if inhaled in high doses during manufacturing. Consumers, who generally only use a little tea tree oil at a time, should not be concerned by the change.

Suppliers, manufacturers, and users of chemical products should check the application documents to see whether their products are affected by the changes.

The Chemical Review aims to ensure that our hazard classifications are in line with others internationally, and that risks are being managed accordingly. The review was undertaken as a modified reassessment, which means that only specific aspects of the approvals were considered during the reassessment, and the approvals cannot be revoked (meaning substances cannot be banned).

This review is part of the EPA's chemical reassessments programme, which includes a Priority Chemicals List of 43 chemicals we believe are most in need of review in New Zealand. More than 1200 chemicals have been screened overall, and we continue to update the Priority Chemicals List as new information becomes available.

Read the Chemical Review decision (PDF, 1MB)

Find out about the chemical reassessment process

New Zealand EPA, 27 May 2021

<https://www.epa.govt.nz/news-and-alerts/latest-news/agrichemicals-and-tea-tree-oil-amongst-chemical-classification-updates/>

**We adopted the GHS 7 on 30 April 2021.**

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### **New Zealand has implemented a new classification system for hazardous substances based on the seventy revised edition of the Globally Harmonised System (GHS 7)**

2021-05-31

The GHS 7 is an international hazard classification system for chemicals created by the United Nations. The hazards are communicated on labels and safety data sheets including how to safely store, use and dispose of chemicals.

The GHS is used by more than 50 countries, including all of New Zealand's major trading partners.

We adopted the GHS 7 on 30 April 2021.

#### **What you need to know**

- Updated EPA notices explain the new product labelling, safety data sheet and packaging requirements. You're encouraged to comply with the new requirements sooner rather than later.
- Substances with an individual approval issued after 30 April 2021 must comply with these three notices immediately.
- Individual approvals issued before 30 April 2021 have a four-year transitional period, through to 30 April 2025, to comply with the updated labelling, safety data sheets and packaging notices.
- Substances managed under a group standard must also comply with the labelling, safety data sheet and packaging notices by 30 April 2025, regardless of when the substance was imported into or manufactured in New Zealand.

Read the EPA Labelling, Safety Data Sheet and Packaging Notices

#### **What happens to my current approval**

- You will need to check what approval your substance is assigned to, especially for individual approvals, as some have changed and some no longer exist. We have revoked more than 5,000 individual approvals as they can be managed under one or more group standards.
- While most group standards have the same scope as the previous group standards a very small number, such as those for aerosols, have changed. Check the group standard that is currently assigned to your substance to ensure it is still appropriate.

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- If the individual approval you use has been revoked, we've suggested a group standard your substance may fit into. However, it's possible another group standard may be a better fit and you should check this.
- You must also ensure your self-assignment records are up to date as soon as possible after 30 April 2021.
- We have not changed HSNO approval numbers so you do not need to update these.

More information, including the new approval documents, can be found at the following page:

Hazardous substance approvals

Read more about the rules, including timeframes to comply

Go to the Group Standards 2020

New Zealand EPA, 31 May 2021

<https://www.epa.govt.nz/industry-areas/hazardous-substances/new-zealands-new-hazard-classification-system/>

### **Sri Lanka faces 'worst beach pollution' in history from burning ship**

2021-05-30

Sri Lanka faces an unprecedented pollution crisis as waves of plastic waste from a burning container ship hit the coast and threaten to devastate the local environment, a top environment official warns.

Thousands of navy sailors have been using mechanical diggers at beaches to scoop up tonnes of tiny plastic granules that have come from the Singapore-registered MV X-Press Pearl, which has been smouldering on the horizon for 10 days.

Sri Lanka's Marine Protection Authority (MEPA) said the microplastic pollution could cause years of ecological damage to the Indian Ocean island.

The tiny polyethylene pellets threaten beaches popular with tourists as well as shallow waters used by fish to breed.

Fishing has been banned along an 80-kilometre stretch of coast near the ship that has been burning for 10 days despite an international firefighting operation.

**Sri Lanka's Marine Protection Authority (MEPA) said the microplastic pollution could cause years of ecological damage to the Indian Ocean island.**

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“There is smoke and intermittent flames seen from the ship,” navy spokesman Captain Indika de Silva said.

Orange-coloured plastic booms were set up in case oil leaks from the crippled ship reached Negombo Lagoon, which is famed for its crabs and jumbo prawns.

[Read More](#)

ABC.net.au, 30 May 2021

<https://www.abc.net.au/news/2021-05-30/sri-lanka-faces-worst-beach-pollution-from-burnt-ship/100176806>

## AMERICA

### In historic move, Chile unanimously approves ambitious single-use plastics law

2021-05-21

In a historic move, Chile’s legislature has unanimously passed a plastic regulation law that advocates say will reduce the country’s plastic waste by more than 23,000 tons every year.

The new law will target single-use plastics in the food industry and introduce a certification for compostable plastics, among other things.

“The approval of this project, supported across the board by parliamentarians and civil society, is a milestone in the care and protection of Chile’s environment,” Chile’s Environment Minister Carolina Schmidt said in a statement.

The new law was developed with the help of nonprofits Oceana Chile and Plastic Oceans Chile. In 2019, the two groups presented a report to Chile’s legislature detailing both the problem of plastic pollution and existing government bans. This report formed the basis for a bill that was introduced in May of the same year.

“After more than two years of hard work, we can celebrate a great victory for the environment, for Chile, and the entire world,” Mark Minneboo, regional director of Latin America for Plastic Oceans International, said in a press release emailed to EcoWatch. “This law is ambitious, but at the same time it’s realistic for where Chile stands regarding waste generation and its technical capabilities to make these changes possible.”

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The bill seeks to reduce single-use plastic pollution by banning hard-to-recycle items from being served in restaurants or through delivery services. Targeted items include plastic plates, cups, straws, cutlery, to-go food containers, sachets, lids and stirrers.

At the same time, the law promotes the use of recyclable materials by creating a certificate program to distinguish truly compostable plastics and mandating that plastics earning this certificate be clearly labeled. The law also requires beverage companies to educate customers about the importance of reusable bottles and mandates that any establishment selling drinks offer reusable alternatives to single-use plastic bottles.

[Read More](#)

EcoWatch, 21 May 2021

<https://www.ecowatch.com/chile-single-use-plastics-law-2653069704.html>

### NIOSH CIB on health effect of occupational exposure to silver nanomaterials includes REL for silver nanomaterials

2021-05-20

The National Institute for Occupational Safety and Health (NIOSH) has published Current Intelligence Bulletin 70: Health Effects of Occupational Exposure to Silver Nanomaterials. According to the Current Intelligence Bulletin (CIB), NIOSH assessed potential health risk from exposure to silver nanomaterials by evaluating more than 100 studies of silver nanomaterials in animals or cells. The CIB states that recent studies in animals have demonstrated that biologic activity and potential adverse health effects are related to particle size. Adverse health effects of nanoscale silver particles, including early stage lung inflammation and liver hyperplasia, have been observed in rats following inhalation exposure. NIOSH considers these responses relevant to workers and estimated the risks to workers based on these animal data. NIOSH derived a recommended exposure limit (REL) for silver nanomaterials (<100 nanometers (nm) primary particle size) of 0.9 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) as an airborne respirable eight-hour time-weighted average (TWA) concentration. The CIB notes that NIOSH continues to recommend a REL of 10  $\mu\text{g}/\text{m}^3$  as an eight-hour TWA for total silver (metal dust, fume, and soluble compounds, as Ag). NIOSH further recommends the use of workplace exposure assessments, engineering controls, safe work

**Adverse health effects of nanoscale silver particles, including early stage lung inflammation and liver hyperplasia, have been observed in rats following inhalation exposure.**

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JUN. 11, 2021

procedures, training and education, and established medical surveillance approaches to protect workers.

[Read More](#)

Nano and Other Emerging Chemical Technologies Blog, 20 May 2021

<https://nanotech.lawbc.com/2021/05/niosh-cib-on-health-effect-of-occupational-exposure-to-silver-nanomaterials-includes-rel-for-silver-nanomaterials>

### Study: Potentially harmful 'forever chemicals' found in popular garden fertilizers

2021-05-25

Some common garden fertilizers sold by major retailers have concerning levels of PFAS compounds, so-called "forever chemicals" that last in the environment for decades and potentially harm health, a new study has found.

The fertilizers in question contain biosolids — sewage sludge sold by wastewater treatment plants after it has been dried and treated for biological contaminants. But it's often not treated for per- and polyfluoroalkyl substances — PFAS — compounds used in a host of commercial products for waterproofing and grease resistance, as well as in many industrial applications. The PFAS compounds have been tied to cancer and other health problems.

It's not just a potential problem for those growing their own fruits and vegetables. The PFAS levels found in biosolids coming from wastewater treatment plants around the country point out the degree to which the chemicals continue to flow from industrial waste streams — and the lack of filtration at the factory or the wastewater treatment plant to remove the chemicals. The environmental nonprofits behind the study present Michigan as a model for other states to follow in identifying and requiring treatment from large industrial contributors of PFAS wastewater.

[Read More](#)

Detroit Free Press, 25 May 2021

<https://www.freep.com/story/news/local/michigan/2021/05/25/pfas-pfos-forever-chemicals-garden-fertilizers/7418828002/>

**The PFAS compounds have been tied to cancer and other health problems.**

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### More chemical regulations for furniture manufacturing

2021-05-25

The furniture industry is no stranger to regulation – we have adapted to comply with hundreds of state and federal regulations. But despite political gridlock at the federal level often slowing down legislative and regulatory efforts, more chemical regulations for furniture manufacturing are on the way. Aggressive regulatory efforts have shifted to states with California leading the way, especially regarding upholstered furniture flammability, formaldehyde emissions, and broader flame retardant chemical bans. Given the size of the California market, some of its regulations can become de facto national standards. These efforts, combined with other state and federal rules, have created significant shifts in furniture manufacturing and, further downstream, furniture retailers.

#### HFA efforts for chemical regulations

Recently, the HFA has been contacted regarding increasing chemical-related legislation/regulation in New York, Washington, and California. In New York, there is a state legislative effort to ban flame retardant chemicals in upholstered furniture and other products like electronics. Previous legislation like this was one of the main motivations for the HFA and other industry stakeholders to strongly support the passage of the Safer Occupancy Furniture Flammability Act (SOFFA) to create a national upholstered flammability standard based on the existing [California Technical Bulletin \(TB\) 117-2013](#). The SOFFA language was ultimately included in December 2020 year-end congressional legislation as the COVID-19 Regulatory Relief and Work from Home Safety Act. Importantly, revisions made by California in 2013 allowed for the standard to be met without the use of flame retardant chemicals. As a result, these chemicals were removed from the upholstered furniture supply chain. These proactive measures allow us to avoid the impacts of specific flame retardant bans, like the current NY legislation, while still producing safe furniture in the marketplace.

[Read More](#)

Home Furnishings Association, 25 May 2021

<https://myhfa.org/more-chemical-regulations-for-furniture-manufacturing/>

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## EUROPE

**Jaguar Land Rover, Google partner to track air quality in Dublin**

2021-05-27

The latest installment of Google's Project Air View outfits Jaguar's new, electric I-PACE with Google Street View technology and mobile air sensors to monitor Dublin's street-level air quality for the next year.

Jaguar Land Rover (JLR) has partnered with Google to integrate its Jaguar I-PACE with air-quality-measuring sensors and Street View mapping technology — part of a collaboration with the Dublin City Council for its Smart Dublin program.

Part of Google's global Project Air View, launched in 2018, the partnership makes the I-PACE the first all-electric Google Street View vehicle. For the next 12 months, they will be used to measure and record street-by-street air quality in Dublin — including nitrogen dioxide (NO<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) emissions, and fine particles (PM<sub>2.5</sub>). It will also help update Google Maps.

The Jaguar I-PACE, which offers zero-tailpipe-emissions driving, has been equipped with specialized mobile air sensors developed by Aclima — with which Google's research partners will analyze the data and develop maps of street-level air pollution.

The partnership comes as Jaguar Land Rover defines its future strategy: a sustainable reimagining of modern luxury, unique customer experiences, and positive societal impact — and a commitment to become a net-zero-carbon business by 2039. To realize this vision, JLR will collaborate with industry leaders to enhance sustainability and reduce emissions as well as sharing best practices in next-generation technology, data and software development.

[Read More](#)

Sustainable Brands, 27 May 2021

<https://sustainablebrands.com/read/cleantech/jaguar-land-rover-google-partner-to-track-air-quality-in-dublin/>

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**Asbestos updates**

2021-06-03

**Asbestos can be found in any building built before the year 2000 and it causes around 5,000 deaths every year.**

HSE has recently published a revised version of an asbestos publication.

The new edition of 'Asbestos: The Analysts' Guide' (HSG248) provides clarification on technical and personal safety issues, especially in relation to sampling and 4-stage clearances. New information on sampling soils for asbestos is also included.

- [Download a free copy of HSG248](#)
- You can also buy a hard copy at the [HSE Books website](#)

HSE is also currently reviewing the regulations around asbestos and wants to hear from you about how they are working.

To help, please [complete this short survey](#). Responses will help us continue to protect people from asbestos and the lung diseases it causes. ~sHSE, 3 June 2021

<https://www.hse.gov.uk/asbestos/>

**Why high levels of PFAS should be a personal injury by law**

2021-06-03

> For decades, the people living in the Swedish town of Kallinge got their tap water from a treatment plant that turned out to be contaminated with harmful PFAS chemicals.

> They sued the municipally owned water company for damages – and won.

> But the water company is appealing the verdict, arguing that high levels of PFAS should not be considered a personal injury. This is why it definitely should be.

It has been a long journey with many legal and medical twists and turns for the close to 5,000 inhabitants of Kallinge since December of 2013. That's when high levels of PFAS – more than 100 times the EU limit value – were discovered in the water treatment plant Brantafors, run by municipally owned water company Ronneby Miljöteknik.

**[T]he PFAS levels in the blood of the people of Kallinge were among the highest measured in the world.**

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The treatment plant was closed and blood samples from residents in the area were collected. The results were shocking; the PFAS levels in the blood of the people of Kallinge were among the highest measured in the world.

### Military drills caused the PFAS contamination

The source of the contamination is the fire foam that the Swedish Armed Forces have been using since the 1980s on the exercise grounds of the air base F17, located near the water treatment plant.

The Armed Forces accepted responsibility for the contamination in 2015, but denied to pay compensation to those affected, arguing that there was no connection between the contamination and any health issues.

#### [Read More](#)

Chemsec, 3 June 2021

<https://chemsec.org/why-high-levels-of-pfas-should-be-a-personal-injury-by-law/>

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## REACH Update

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### Stakeholder survey begins on nanomaterials available in EU market

2021-05-26

The European Chemicals Agency (ECHA), as part of the activities of the European Union (EU) Observatory for Nanomaterials (EUON), is conducting a [stakeholder survey](#) on the substances available as nanomaterials in the EU market. The survey includes a market study of the nanomaterials, including substances, uses, volumes, and key operators in the EU. According to EUON's May 21, 2021, [news item](#), the survey aims to provide an overview of the substances that are available as nanomaterials on the EU market, as well as insight into their main areas of application and approximate volumes. Stakeholders are invited to complete a short questionnaire on the nanomaterial substances they produce, trade, or use. Respondents can also indicate their willingness and consent to participate in upcoming focus groups that are intended to provide a "realistic" projection of the growth of the nanomaterials market over the next five years.

#### [Read More](#)

Nano and Other Emerging Chemical Technologies Blog, 26 May 2021

<https://nanotech.lawbc.com/2021/05/stakeholder-survey-begins-on-nanomaterials-available-in-eu-market>

### REACH and CLP have improved protection—but more needs to be done

2021-06-01

Europe's workers, consumers and the environment are better protected from harmful chemicals thanks to the EU's chemicals laws, REACH and CLP. Despite progress, changes are needed to ensure they work more effectively to protect European citizens and ecosystems.

Helsinki, 1 June 2021 – ECHA's third report on the operations of REACH and CLP illustrates the impacts that the legislation has had on people's health, environment, internal market, competitiveness and innovation, as well as the promotion of alternatives to animal testing.

REACH and CLP have improved the protection of health and the environment. Harmful chemicals are now identified much more quickly compared to the past, and significant action has been taken to regulate them, reducing risks for workers, consumers and the environment.

**The survey includes a market study of the nanomaterials, including substances, uses, volumes, and key operators in the EU.**



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## REACH Update

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With ECHA's chemicals database a prime source of information, the legislation has improved transparency on substances, their hazards and uses. This allows authorities, companies, workers and consumers in the EU and beyond to make better informed decisions on chemical safety. Efforts to increase the predictability of upcoming regulatory actions has encouraged greater market trust and has helped companies to better plan their operations and invest early on in finding safer alternatives.

However, synergies between REACH, CLP and other legislation such as worker protection legislation, have often failed to materialise. This creates a lack of clarity on how substances are dealt with across different pieces of legislation. Much more still needs to be done to make the regulations work more effectively and to make progress towards the 'one substance, one assessment' ambition.

"Although we know a lot more today about chemicals in the EU, further improvements are needed so we can meet the protection goals set in the legislation. We continue to see significant discrepancies in safety data submitted by companies in their registrations compared to the information we receive during consultations once authorities consider risk management activities on a chemical. This gap must close," says *Bjorn Hansen*, ECHA's Executive Director.

With this report, ECHA provides facts to support further policy developments and to identify areas where the functioning of REACH and CLP can be improved. The report is ECHA's contribution to the European Commission as they start with the third review of REACH and CLP in 2022.

[Read More](#)

ECHA, 1 June 2021

<https://echa.europa.eu/-/reach-and-clp-have-improved-protection-but-more-needs-to-be-done>

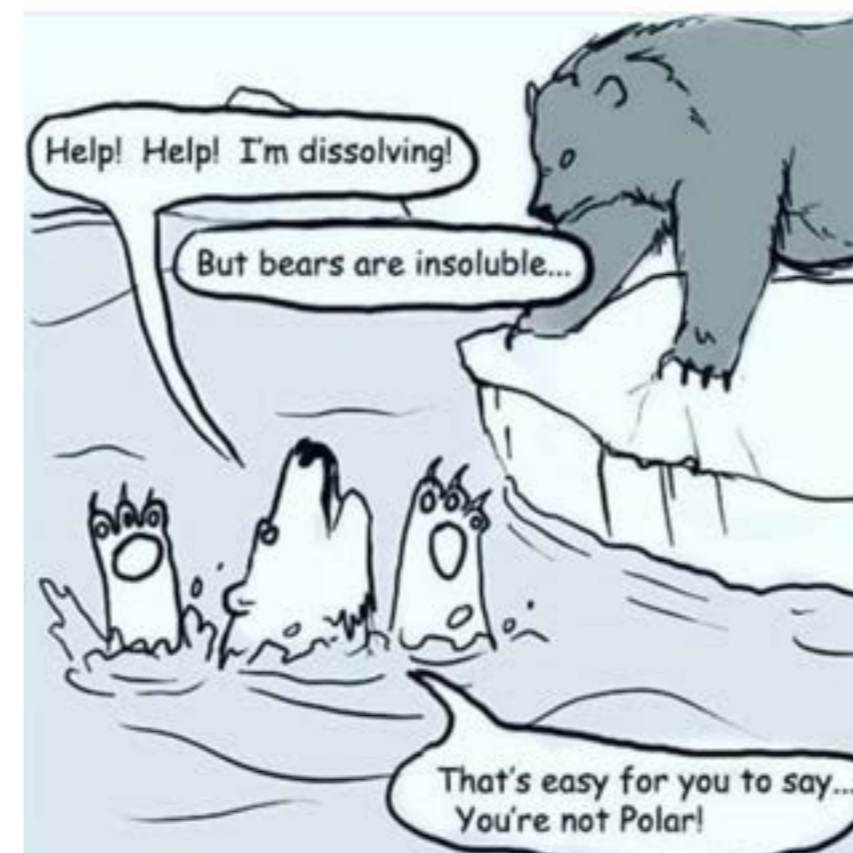
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## Janet's Corner

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### Polar Bear

2021-06-11



<https://nerd-memes-only.tumblr.com/post/186446774781>

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## Hazard Alert

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### Pentachlorophenol

2021-06-11

Pentachlorophenol is a manufactured chemical with the molecular formula  $C_6HCl_5O$ . [1] It does not occur naturally. Pure pentachlorophenol exists as colourless crystals. Impure pentachlorophenol (the form usually found at hazardous waste sites) is dark grey to brown and exists as dust, beads, or flakes. Humans are usually exposed to impure pentachlorophenol (also called technical grade pentachlorophenol). [2]

#### USES [3,4,5]

Pentachlorophenol was used as a biocide to kill small organisms and is now used as a wood preservative to protect wood from decay and insect attack. Since 1984, the purchase and use of pentachlorophenol has been restricted to certified applicators. It is no longer available to the general public. Pentachlorophenol is applied commercially in the treatment of utility poles, fences, shingles, walkways, building components, piers, docks and porches, and flooring and laminated beams. It is also used in agricultural purposes such as wood protection treatment to buildings or products, and fencerows or hedgerows.

#### IN THE ENVIRONMENT [4]

Pentachlorophenol can be found in the air, water, and soil. It enters the environment through evaporation from treated wood surfaces, industrial spills, and disposal at uncontrolled hazardous waste sites. Pentachlorophenol is broken down by sunlight, other chemicals, and microorganisms to other chemicals within a couple of days to months. Pentachlorophenol is found in fish and other foods, but tissue levels are usually low.

#### SOURCES & ROUTES OF EXPOSURE

##### Sources of Exposure [6]

- Exposure to pentachlorophenol in the indoor air of pressure-treated log homes brushed with pentachlorophenol has been measured at 0.0005 to 0.01 parts per billion (ppb), and levels in the air of industrially dipped, non-pressure-treated log homes have been measured at 0.034 to 0.0104 ppb.
- Levels in outdoor air are much lower, and the general population is estimated to breathe in about 0.063 milligrams per day (mg/day).

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- Workers at wood treatment facilities and lumber mills are estimated to breathe in about 10.5 to 154 mg/day, and workers who handle treated lumber can absorb about 35 mg/day through the skin.
- Pentachlorophenol has been detected at low levels in drinking water and food.
- Exposure may also occur through dermal contact with pentachlorophenol or with wood products treated with pentachlorophenol.

#### Routes of Exposure [3]

The major route of exposure to pentachlorophenol is via inhalation of contaminated air. Exposure may also occur via the ingestion of contaminated food or water. Furthermore, pentachlorophenol can also enter your body through skin contact and can leave your body through urine.

#### HEALTH EFFECTS [6]

##### Acute Effects

Pentachlorophenol is extremely toxic when ingested by humans. Acute inhalation exposure to pentachlorophenol in humans may result in effects on the cardiovascular system, blood, liver (jaundice), and eyes (visual damage and irritation). Neurological effects reported following exposure of humans to high levels of pentachlorophenol include lethargy, tachypnea, tachycardia, delirium, and convulsions. Animal studies have reported effects on the cardiovascular system, blood, liver, immune system, and central nervous system (CNS) from acute oral exposure to pentachlorophenol. Tests involving acute exposure of rats and mice have shown pentachlorophenol to have high toxicity from inhalation exposure and extreme toxicity from oral exposure.

##### Chronic Effects

Chronic exposure by inhalation to pentachlorophenol in humans has resulted in inflammation of the upper respiratory tract and bronchitis, blood effects such as aplastic anaemia, effects on the kidney and liver, immunological effects, and irritation of the eyes, nose, and skin. Chronic oral exposure to pentachlorophenol in animals has resulted in effects on the liver, kidney, blood, endocrine, immune system, and CNS. EPA has not established a Reference Concentration (RfC) for pentachlorophenol. The Reference Dose (RfD) for pentachlorophenol is 0.03 milligrams per kilogram body weight per day (mg/kg/d) based on liver and kidney

**Pentachlorophenol is a manufactured chemical with the molecular formula  $C_6HCl_5O$ .**

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pathology in rats. The California Environmental Protection Agency (CalEPA) has calculated a chronic inhalation reference exposure level of 0.1 milligrams per cubic metre (mg/m<sup>3</sup>) based on a route-to-route extrapolation of EPA's RfD.

### Reproductive/Developmental Effects

One study reported that 22 out of 90 women with histories of spontaneous abortions, unexplained infertility, or menstrual disorders were found to have elevated blood levels of pentachlorophenol and/or lindane. However, a direct causal relationship with pentachlorophenol exposure cannot be inferred from this study due to the presence of lindane in the blood and other possible confounding factors. Oral animal studies suggest that exposure to pentachlorophenol decreases the survival of the offspring in rats. Other oral animal studies have found evidence that pentachlorophenol produces maternal toxicity (depressed maternal body weight), but does not cause birth defects.

### Cancer Risk

Case reports suggest a possible association between inhalation pentachlorophenol exposure and cancer (Hodgkin's disease, soft tissue sarcoma, and acute leukaemia); however, concomittent exposure to other toxic substances may have contributed to the reported carcinogenic effects. Oral animal studies have reported increases in liver tumours (hepatocellular adenomas and carcinomas) and two uncommon tumours (adrenal medulla pheochromocytomas, hemangiosarcomas, and hemangiomas) in mice. EPA has classified pentachlorophenol as a Group B2, probable human carcinogen.

### SAFETY [7]

#### First Aid Measure

- **Eye Contact:** Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.
- **Skin Contact:** After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention.

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- **Serious Skin Contact:** Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- **Inhalation:** Allow the victim to rest in a well-ventilated area. Seek immediate medical attention.
- **Serious Inhalation:** Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
- **Ingestion:** Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

### Exposure Controls & Personal Protection

#### Engineering Controls

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

#### Personal Protective Equipment

The following personal protective equipment is recommended when handling pentachlorophenol:

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

Personal Protection in Case of a Large Spill:

- Splash goggles
- Full suit
- Dust respirator
- Boots

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

### REGULATION [4,8,9]

#### United States

OSHA: The Occupational Safety & Health Administration has established the following Permissible Exposure Limits (PEL):

- General Industry: 0.5 mg/m<sup>3</sup> (Skin)
- Construction Industry: 0.5 mg/m<sup>3</sup> TWA (Skin)

ACGIH: The American Conference of Governmental Industrial Hygienists has set the following Threshold Limit Value (TLV):

- 0.5 mg/m<sup>3</sup> TWA (Skin)
- Appendix A3 (Confirmed Animal Carcinogen with Unknown Relevance to Humans)

NIOSH: The National Institute for Occupational Safety and Health has established the following Recommended Exposure Limit (REL):

- 0.5 mg/m<sup>3</sup> TWA (Skin)

EPA: The Environmental Protection Agency has set a limit for drinking water of 1 part of pentachlorophenol per billion parts of water (1 ppb).

#### Australia

Safe Work Australia: Safe Work Australia has established a time weighted average concentration for pentachlorophenol of 0.5mg/m<sup>3</sup> for an 8-hour workday.

Australian Drinking Water Guidelines specifies a limit of 0.01 mg/L for pentachlorophenol

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# Bulletin Board

## Gossip

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### Giant diamonds may hold the key to superdeep earthquakes

2021-06-01

Earthquakes shouldn't occur more than 300 kilometers below Earth's surface, according to most geophysical models. Yet they commonly do—a phenomenon that has mystified seismologists for decades. Now, researchers suggest water carried by tectonic plates shoved beneath continents could be triggering these deep temblors. The find may also explain another marvel: why a huge number of fist-size diamonds form at this depth.

Earthquakes typically occur when the two sides of a fault, or the opposite sides of a tectonic plate boundary, scrape past each other. But far beneath our planet's surface, the pressures are too high for such slippage, and rocks are typically so hot they ooze and flow rather than break. That has led geophysicists to come up with alternate explanations for deep seismic activity, which can be very strong but largely too far away for us to feel.

One idea is that some minerals, under the extreme heat and pressure deep within our planet, can suddenly lose volume, with the runaway collapse over large distances causing strong quakes. A second notion is that once a quake gets going—because of the sudden collapse of minerals or another cause—rocks near the tip of the rupture heat up even further and weaken, fueling the quake. A third cause might be water released from rocks deep below Earth's surface, which could weaken other rocks nearby, allowing them to fracture more easily. Researchers have largely dismissed that explanation, however, because it wasn't clear where such water would come from.

Steven Shirey, a geochemist at the Carnegie Institution for Science, had a hunch: diamonds. The precious gems can accumulate layers as they grow, gathering imperfections—such as flecks of surrounding rocks—as they get bigger. Those so-called inclusions can also contain pockets of mineral-rich water.

To see whether the idea could work, Shirey and his team took a closer look at how water might make its way down deep. The answer, they believe, is that it rides down within tectonic slabs as they get shoved beneath continents. There are three sources of water, they postulate. One was the water was locked in the minerals that formed as molten rock hardened at midocean ridges. Another was the wet sediments that accumulated on

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those slabs as they moved across the ocean floor. And the third was ocean water that infiltrated the slabs as they bent and fractured.

Then, the scientists used computer simulations—and the results of previous lab studies by their team and others—to study how minerals in those slabs would behave as they moved deeper and deeper. In general, as depth within Earth increases, so do temperature and pressure. Although slabs can start out relatively cool at Earth's surface, they warm up as they sink. And because they're many kilometers thick, it often takes millions of years for the slabs to heat throughout.

Regardless of depth, Shirey and his team found that once rocks in the slabs reached temperatures above 580°C, they were less able to hold water. As that water flooded out of the slab, it weakened the surrounding rocks and triggered quakes, Shirey and his colleagues report in *AGU Advances*. This water, typically chock-full of dissolved minerals, would also be available to fuel diamond formation.

"The temperature tells the story," says Douglas Wiens, a seismologist at Washington University in St. Louis who was not involved in the new study. If the tectonic slab starts out hot, as it would if the rocks are relatively young, he says, the plate will dehydrate at depths between 100 and 250 kilometers and thus won't carry water far enough down to generate deep quakes. But if rocks in the sinking slab are old and relatively cool, water will stay locked inside the sinking slab for a longer time, persisting there until it is released at depths of 300 to 500 kilometers or more.

Further work in both the lab and the field will be needed to fully understand the relationships between water released from sinking slabs and deep earthquakes, Wiens says. In the meantime, he says, it's clear that diamonds that form at those depths, imperfections and all, will be critical to teasing out the details of the story.

[sciencemag.org](https://www.sciencemag.org), 1 June 2021

<https://www.sciencemag.org>

### Watchdog group finds toxic 'forever chemicals' in popular flea and tick collars

2021-06-02

Two popular pet flea and tick products contain toxic "forever chemicals" linked to significant human health issues, according to testing by a nonprofit watchdog group.

**But until this testing, pet products were not known to contain PFAS.**

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Seresto flea and tick collars and Frontline topical treatments each tested positive for PFAS, a class of more than 9,000 man-made chemicals linked to cancer, liver damage and lower birth weights even at extremely small levels.

Flea and tick products are designed to release pesticides that persist for weeks or months at a time, staying on the fur of an animal. Humans can often be exposed to the pesticides by petting, sleeping with and sitting on the same surfaces as pets. These products have been linked to hundreds of adverse incidents involving humans.

But until this testing, pet products were not known to contain PFAS.

"This shows these chemicals are a constant presence in our house, on the rug, on the furniture or on the bed or wherever a pet goes," said Kyla Bennett, a scientist and attorney formerly with the Environmental Protection Agency.

The testing was conducted by an independent lab and paid for by Public Employees for Environmental Responsibility, a nonprofit organization of current and former government employees working to hold their agencies to a higher standard. In recent years, PEER has found the EPA to be negligent in testing for PFAS and has decided to undergo its own testing of products, said Bennett, the group's science policy director.

The testing found:

- Frontline Plus for Dogs, one of many topical treatments used to help control flea and ticks on pets sold under the brand name Frontline, contains 2,390 parts per trillion of four different PFAS.
- Seresto flea and tick collars contain 250 parts per trillion of a long-chain PFAS, which means the chemical is more likely to persist.

The EPA has recommended a 70 parts per trillion lifetime limit for PFAS in drinking water, though it has not yet set formal regulations. Scientists and environmental groups have called for limits as low as 0.1 ppt, and many states have set their own standards for PFAS in drinking water.

The EPA said PFAS are not ingredients in the products. This means the chemicals somehow leach into the collars somehow, either through the container they are stored in or another mechanism, experts said.

The agency added it has received the group's data and is reviewing it as part of a larger investigation into PFAS contamination in pesticide

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products. It said it will work with Elanco, the maker of Seresto, and Boehringer Ingelheim, the maker of Frontline, on "next steps if needed."

"More broadly, Administrator (Michael) Regan has called on the agency to build on its ongoing work to better understand and ultimately reduce the potential risks caused by PFAS chemicals," the statement said.

"Over the past few years, science has progressed rapidly, and the agency must move forward with actions that are based on this new science and a better understanding of the complex challenges," the statement continued. "EPA's research on PFAS is helping to deepen the agency's understanding of these chemicals so that we can take the right steps to continue reducing risks to public health."

Keri McGrath, a spokeswoman for Elanco, said the PEER test was on one Seresto collar, and the finding was just above the detectable limit of the testing method. McGrath pointed out that many household substances, including "fast food containers, pizza boxes and candy wrappers," contain PFAS.

Mark Bixler, a spokesman for Boehringer Ingelheim, said the "health and safety of pets, their owners and the environment, as well as the integrity of our products, have always been and will always be our top priorities." Bixler said the products have been approved in more than 150 countries and have performed safely since they were introduced in 1994.

The EPA asked states to stop spraying another pesticide, called Anvil 10+10, after PEER testing showed it had 250 parts per trillion of a PFAS — the same level as the Seresto collar that was tested. The agency determined the pesticide's use to control mosquitoes risked contaminating drinking water, according to the Boston Globe. It was later determined that the PFAS was likely being leached into the pesticide from its storage containers.

A February 2020 peer-reviewed study found that cats and dogs in New York have levels of PFAS in their feces that are above the minimal level of concern.

Kurunthachalam Kannan, a professor of pediatrics and environmental medicine at New York University and co-author of that study, said that, while some pet foods have been shown to have PFAS, the study showed that pets have higher levels of PFAS in their feces than expected.

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"Pets are excreting more than what they are eating. It means there are other sources," Kannan said. "Now we see that sources like this can contribute to the exposure."

Kannan said that it is unclear at what level PFAS has an effect on pet health, but low levels of the chemicals have been linked to liver damage and cancer in humans. Kannan said high levels in pets is likely an indicator for high levels in humans.

Multiple studies have also shown that active ingredients in pet collars can end up in nearby water sources. The pesticides imidacloprid and fipronil have contaminated rivers in England because of pet treatments, according to researchers at the University of Sussex.

Bennett said, even in the small New England town where she lives, there are likely thousands of dogs wearing the collars or being treated with the spot-on treatments. Each time those dogs are washed, she said, the chemicals have the potential to contaminate water supplies.

PFAS compounds are found in many products, so it was not surprising to see they are in pet flea and tick treatments, said Linda Birnbaum, former director of the National Institute for Environmental Health Sciences and the National Toxicology Program at the U.S. Department of Health and Human Services.

"They're turning out to be everywhere," Birnbaum said.

Birnbaum said the chemicals, even at levels like those found in the collars, pose a risk to humans. Birnbaum said an investigation should be launched into why they're in the products and what can be done to prevent it.

"These are not nice chemicals," Birnbaum said. "They're all very persistent. They're going to build up in the body, so why are we exposing ourselves?"

Heather Stapleton, a professor of environmental sciences and policy at Duke University, said she is not surprised to see the chemicals in pet products because they have been found in other pesticide products.

Stapleton said she would like to see much more testing of the products in order to make a determination about their safety, but the presence does raise concerns for pets and pet owners.

In recent months, the Seresto collar has been the subject of a Congressional inquiry and an EPA investigation after Investigate Midwest and USA TODAY reported the EPA had received more than 75,000 reports

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of adverse incidents, including about 1,700 pet deaths, related to the collar.

Frontline treatments have also had a large number of adverse incidents, EPA data show.

Scott Belcher, a research professor of toxicology at North Carolina State University, said the levels are so low that they likely aren't contributing to adverse incidents in pets.

"I would not be at all concerned about PFAS exposure compared to the impacts of the pesticide," he said. "That's a pesticide toxicity, not a PFAS toxicity."

Still, the pet products are yet another avenue of potential exposure to these toxic chemicals.

"It's one more place where we're using PFAS where we probably shouldn't," Belcher said.

[investigatamidwest.org](https://www.investigatamidwest.org), 2 June 2021

<https://www.investigatamidwest.org>

### Human life span may have an 'absolute limit' of 150 years

2021-05-30

Humans may be able to live for between 120 and 150 years, but no longer than this "absolute limit" on human life span, a new study suggests.

For the study, published online May 25 in the journal *Nature Communications*, the researchers used mathematical modeling to predict that after 120 to 150 years of age, the human body would totally lose its ability to recover from stresses like illness and injury, resulting in death. If therapies were to be developed to extend the body's resilience, the researchers argue, these may enable humans to live longer, healthier lives.

Studies like this one "rely on historic and present data from populations of people," Judith Campisi, a professor at the Buck Institute for Research on Aging in Novato, California, told *Live Science*. "It's guessing, but based on good numbers," added Campisi, who is also a senior scientist at the Lawrence Berkeley National Laboratory. (Campisi was not involved in the new study.)

**If therapies were to be developed to extend the body's resilience, the researchers argue, these may enable humans to live longer, healthier lives.**

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The researchers analyzed large datasets from the U.S., the U.K. and Russia, which together include anonymized medical data for more than 500,000 people. They utilized data from a simple blood test, available for almost everyone in the datasets. Individuals took the blood tests several times over the course of a few months.

The researchers looked at two numbers collected from blood tests for three different age groups: a ratio of two different types of disease-fighting white blood cells; and a measure of variability in the size of red blood cells. Just as a person might have grayer hair as they age, said Dr. Marc J. Kahn, dean of the Kirk Kerkorian School of Medicine and vice president for health affairs at the University of Nevada, Las Vegas, these two numbers go up as a person ages. Scientists call these biomarkers of aging.

## PLAY SOUND

From those blood tests, they then used a computer model to determine what they called dynamic organism state indicator, or DOSI, for each person — essentially a measure of “biological age” that they could use along with the time between blood tests to quantify how well a person would be able to recover from a stress, like illness or injury.

“The authors are able to use this DOSI ... to measure recovery time,” said Kahn, who was not involved in the current study. “The problem is at a certain point in aging, the recovery time is so great that we lose resiliency.” Based on trends in the data, the researchers found that sometime between 120 and 150 years old, resiliency would entirely cease and a person would be unable to survive.

Researchers also looked at data on physical activity, measured in number of steps per day, to validate their results. They found the same pattern: Younger people tended to take more steps each day, while older people took fewer daily steps as they aged. Extrapolating from the data, the researchers found roughly the same age limit as they did from the DOSI measure.

This study isn’t the first to use modeling to examine human life span. Jan Vijg, a geneticist at Albert Einstein College of Medicine, led a study detailed in 2016 in the journal *Nature*, that analyzed trends in life expectancy data to estimate that it would be unlikely for humans to exceed 125 years old. Other researchers have argued that there is no ultimate limit on human life span.

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Even though the research suggests humans could live to 150, that number doesn’t say anything about the quality of life in old age, Campisi said. In recent years, many scientists have come to refer to the number of healthy years in a person’s life as their health span.

“That has huge societal implications, much more than maximum life span,” Campisi said. Health in old age not only impacts a person’s life, but also can have huge costs in terms of time, money, and medical resources, among others.

The researchers argue that if there were a way to increase resiliency in old age, it would not only increase human life span, but also health span, since older people would be able to recover more easily from illness and injury. To increase resiliency, Kahn could see efforts to create mechanical organs or to come up with ways to reprogram aging cells.

“Now, we’re talking about the whole concept of human and mechanical constructs that are features of science fiction,” Kahn said. But the study suggests “it’s really going to take those types of things to extend human [life span].”

Of course, human life span is highly variable, and Campisi said that there’s always a question of whether this type of data is generalizable. The datasets used in the study, though extensive, came only from a few countries. The number the researchers came up with is also an average and applies to humans as a population; — there are still countless factors, from income to diet, that might influence how long an individual person lives. Studies like this, she said, are inexact by nature. But barring changes to the fundamental biology of humans, there is one thing that is certain, Campisi said.

“For sure, we’re all going to die,” she said.

The researchers of the study are from the Singapore-based biotech company Gero, Roswell Park Comprehensive Cancer Center in Buffalo, New York, and the Kurchatov Institute in Moscow.

Originally published on Live Science.

[livescience.com](https://livescience.com), 30 May 2021

<https://www.livescience.com>



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### 'Toxic timebombs': The problem with the plan to stop the mouse plague

2021-05-30

A highly toxic poison being released for free by the NSW government to control the mouse plague could have serious effects on farm animals and wildlife but do little to curb the rodent explosion.

Scientists and farmers say the plan by Agriculture Minister Adam Marshall to begin distribution of 10,000 litres of bromadiolone once he got the nod from the Australian Pesticides and Veterinary Medicines Authority will put at risk any scavenger animal that eats the poisoned mice.

As a second-generation coagulant, bromadiolone needs only one feeding by the animal before it dies from uncontrolled bleeding. However, the poison can accumulate in the food chain, killing animals from lizards to kookaburras, owls and eagles that eat the sick or dead mice, said Peter Brown, team leader of CSIRO's Rodent Management Team.

Dr Brown said the potency of an alternative, zinc phosphide, had recently been doubled and it had few secondary poisoning risks because it does not accumulate.

"We think that's the best option," he said, adding that there was not a blanket approval for zinc phosphide use either, with a ban on its application within 50 metres of native vegetation.

Xavier Martin, a grain grower from Mullaley on the Liverpool Plains and vice president of NSW Farmers, said croppers and graziers were exhausted by the mouse plague. They're being bitten in their beds, draining contaminated water from their tanks and are spending thousands of dollars on approved poisons such as zinc phosphide, he said. The plague could wipe \$1 billion off the value of winter crops.

"Zinc phosphide kills almost instantly, or certainly within the hour," Mr Martin told the Herald as he drove a tractor on his farm, planting the summer wheat crop. By contrast, bromadiolone can take as long as a week to kill mice and in that time the animals can destroy a crop such as canola.

Also, if previous restrictions are applied, bromadiolone would only be permitted on the perimeters of paddocks, leaving the mouse hordes already ensconced unaffected. "They are not lining up around the fence line, waiting for the Marshall Plan," he said. "It's not realistic that is a solution."

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Associate Professor Bill Bateman from Curtin University's School of Molecular and Life Sciences said his group found many reptiles would bio-accumulate the poison: "[As] reptiles seem to be able to survive a bit longer after rodenticide uptake they themselves then become 'toxic timebombs', waiting to poison any predator that might eat them."

"Of course, baiting with these toxins can also impact our farm animals, pets and working animals – both during baiting and long after," Professor Bateman said earlier this month. "A recent review paper showed that, as large reptiles can be part of human diet both in Australia and other regions, ultimately humans can also be at risk of rodenticide poisoning."

Mr Marshall was asked about the secondary effects of bromadiolone and when he expected the regulator to approve it for the 400-plus farmers who have already signed up.

"I've been on the ground, I live in the bush and I speak to farmers every day and many are asking for bromadiolone to help fight these vermin and this early enthusiasm shows that," Mr Marshall said in a statement.

"Landholders will be able to surround their crops with bromadiolone-treated grain, which when used in combination with zinc phosphide to kill off mice already in the paddock, will give farmers a multi-layered defence," he said.

A spokesman for the regulator said it had asked the NSW government for additional information on May 20 about the emergency permit being sought and had yet to receive a response.

The NSW Environment Protection Authority was also approached for comment.

Mr Martin of NSW Farmers said the government's "inaction has turned it into a plague", resulting as in as much as \$1 billion of farm output being lost. That sum would be higher once the value of lost work for food and drink processing industries was taken into account.

He said neither Premier Gladys Berejiklian nor Deputy Premier John Barilaro had visited farms hit by the plague. "The good news is they won't have to go very far," Mr Martin said, noting there were reports of mice reaching farms on the coast and also in areas near Sydney such as the Hawkesbury Valley.

smh.com.au, 30 May 2021

<https://www.smh.com.au>

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**Mysterious event nearly wiped out sharks 19 million years ago**

2021-06-04

Some 19 million years ago, a mystery event nearly drove the world's entire population of sharks to extinction, according to a new study.

About 90% of sharks disappeared from the oceans in less than 100,000 years, but it's unknown why and whether they died off in a single day, weeks, years or even thousands of years. This extinction event significantly altered the ancient marine environment, and sharks never recovered from the die-off, according to the study, which was published Thursday (June 3) in the journal *Science*.

"Sharks have been around for 400 million years; they've weathered a lot of mass extinctions," some of which wiped out almost all life, said co-author Elizabeth Sibert, a postdoctoral fellow at Yale University's Institute for Biospheric Studies (who was a junior fellow at Harvard University at the start of the research). Yet during the early Miocene epoch, something "clearly happened to almost wipe this group off of the face of this Earth."

This story was hidden inside a largely ignored group of ichthyoliths, which are microscopic fossils of shark scales (called denticles) and fish teeth buried deep inside sediments on the ocean floor.

Ichthyoliths are found in most types of sediments, but they are tiny and relatively rare compared with some other microfossils that are better studied, Sibert said. In fact, though some scientists studied ichthyoliths in the 1970s and '80s, few researchers had examined them in the decades since, until Sibert investigated them for her doctorate, which she completed in 2016.

"A lot of what I've done in my early career as a scientist was figuring out how to work with these fossils, what kinds of questions we can ask about them," Sibert told Live Science.

Ichthyoliths are found inside deep sediment cores, or sediments that have been stacked on the ocean floor over millions of years. The deeper the sediment, the older it is, with some sediment cores dating back 300 million years, Sibert said. These sediment cores allow researchers to create a time series: A certain number of inches down the core equals a certain number of years in history.

**"Sharks have been around for 400 million years; they've weathered a lot of mass extinctions," some of which wiped out almost all life, said Elizabeth Sibert [...].**

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Sibert and another group of researchers previously discovered that the number of shark ichthyoliths in such cores greatly declined 19 million years ago, but it wasn't clear if this drop represented an extinction event.

In this new study, Sibert and co-author Leah Rubin, who was an undergraduate student at the College of the Atlantic in Bar Harbor, Maine at the time of the research, analyzed sediment cores taken many years ago by deep-sea drilling projects at two different sites: one in the middle of the North Pacific, and one in the middle of the South Pacific.

"We picked those sites particularly because they are far away from land and they're far away from any influences of changing ocean circulation or ocean currents," Sibert said. In other words, they wanted to make sure that the changes in ichthyoliths they saw weren't due to other variables, such as the migration of sediments across the ocean.

However, only the South Pacific site had data from 19 million years ago. The other sediment core had data from 22 million to 35 million years ago and from 11 million to 12 million years ago, but nothing in between. (These earlier and later cores still helped the researchers understand what fossils were present long before and long after that time period.) After extracting the ichthyoliths from the sediment cores, the researchers examined two specific metrics: abundance and diversity of shark fossils.

**Extreme decline**

By looking at before-and-after snapshots in the sediment cores, the researchers found that open-ocean shark fossil numbers dropped by 90% around 19 million years ago. But to understand whether this was truly an extinction, the researchers wanted to understand if diversity — the number of different shark species — also declined.

To measure diversity, they classified 798 denticles from the South Pacific and 465 from the North Pacific into 80 different morphologies, or shapes and structures. They found that around that time, about 70% of denticle types disappeared. The researchers also put together a catalog of modern shark denticles and found that another 20% of those pre-extinction event morphologies were present in modern sharks but not in the fossil record.

In other words, this lost extinction event wiped out between 70% and 90% of shark species and 90% of individual sharks.

Related: The 5 mass extinction events that shaped the history of Earth

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"Frankly, we're shocked that this time period had such a dramatic event," Sibert said. The disappearance of sharks greatly altered the marine communities, disrupting 45 million years of stability, she added. In fact, the last time the marine vertebrate community had such a shake-up was 66 million years ago, in the late Cretaceous period, when an asteroid wiped out the nonavian dinosaurs.

"I think what has been the most surprising is just how extreme" the decline in shark diversity and abundance truly was during this time period, Rubin, who is now an incoming doctoral student at the State University of New York College of Environmental Science and Forestry, told Live Science in an email. The "million dollar question" is, what caused it?

No clear environmental driver, such as a major change in climate, accounts for this significant decline in sharks. And predators probably didn't drive sharks to extinction, as this die-off occurred several million years before tuna, billfish, seabirds, beaked whales and even migratory sharks exploded in numbers.

"We really, truly don't know" what caused the extinction, Sibert said. "This paper is just the very beginning of what I hope is going to be a really interesting next decade trying to figure out more about what happened at this time."

## Missing fossils

Romain Vullo, a paleontologist with the French National Center for Scientific Research (CNRS) at the Géosciences Rennes, in France, who was not part of the study, said the findings were surprising. They can't be explained by a known global climate event at the time, and the extinction isn't seen in the global fossil record of sharks, he told Live Science in an email.

Still, "further data from other regions in the world would be required to confirm the interpretation of the authors," he added. Though two sites were analyzed, only the sediment core from the South Pacific specifically pointed to this 19-million-year-old extinction event and decline in abundance. It's possible that the data may reflect local changes and not a global extinction event, he said.

Sibert said it's possible but unlikely that it would be a local change. "While we don't have good data from this very specific time interval all over the world, we do have a lot of 'before' extinction snapshots and

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'after' extinction snapshots from all over the world," she said. "Before the extinction, there are lots of shark scales, and after, there are not."

If this were a local phenomenon, a lot of shark fossils would be found in sediments that date back younger than 19 million years old, but they aren't, she said. "They're missing pretty much everywhere that we have looked," Sibert said.

However, "it is possible that this extinction was strongest in the open ocean environment, and not in the coastal environment," she added. The next steps are to figure out if species along the coasts, as well as other groups or ecosystems, were also greatly affected, she said.

## Modern sharks, ancient lessons

One reason this shark tale wasn't told until today is that this time period, from 18 million to 20 million years ago, is mostly missing in sediment cores. It's not clear why this time period is hard to come across in the sediment record. It could have something to do with the extinction event, or it could just be "random happenstance," Sibert said.

It's puzzling that "this event in the early Miocene seems to have been hiding in an interval of geologic time that was previously unremarkable," Catalina Pimiento, a vertebrate paleontology researcher at the University of Zurich and Swansea University in the U.K. and Nicholas D. Pyenson, a research geologist at the Smithsonian Institution in Washington, D.C. and affiliate curator of vertebrate paleontology at the Burke museum in Seattle, Washington, wrote in an accompanying perspective piece published in the journal *Science*. Neither of them were involved in the study.

"Our view of the ancient oceans is constrained by the environments recorded in the rock record, which are often limited to shallow-water deposits that provide little insight into the oceanwide history of pelagic [oceanic] faunas," they wrote.

And, it turns out, this ancient story has modern parallels.

In the past 50 years, shark numbers have declined by more than 70%, due to overfishing and other human pressures, including climate change warming the oceans. One-quarter of shark species that exist today are currently threatened with extinction, according to the perspective piece.

"The parallels between this ongoing crisis and the extinction of pelagic sharks more than 19 million years ago thus feels like déjà vu, except that

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this time, we know that the decline of sharks is happening at a faster rate than at any other in the history of the planet," Pimiento and Pyenson wrote.

Sharks and other marine predators play an invaluable role in keeping the ocean ecosystem balanced. "These big changes in large marine organism populations and diversity can have knock-on effects that can really change the ecosystem forever," Sibert said.

The Miocene extinction event "fundamentally changed and really disrupted the whole ocean ecosystem and caused it to flip into an entirely new state," Sibert said. Sharks have not recovered in diversity or number from this major extinction event that seemed to have occurred 19 million years ago. Now, Sibert said, we're once again at a "tipping point."

[livescience.com](https://www.livescience.com), 4 June 2021

<https://www.livescience.com>

### Pesticides are killing the world's soils

2021-06-01

Scoop up a shovelful of healthy soil, and you'll likely be holding more living organisms than there are people on the planet Earth.

Like citizens of an underground city that never sleeps, tens of thousands of subterranean species of invertebrates, nematodes, bacteria and fungi are constantly filtering our water, recycling nutrients and helping to regulate the earth's temperature.

But beneath fields covered in tightly knit rows of corn, soybeans, wheat and other monoculture crops, a toxic soup of insecticides, herbicides and fungicides is wreaking havoc, according to our newly published analysis in the journal *Frontiers in Environmental Science*.

The study, the most comprehensive review ever conducted on how pesticides affect soil health, should trigger immediate and substantive changes in how regulatory agencies like the EPA assess the risks posed by the nearly 850 pesticide ingredients approved for use in the U.S.

Currently, regulators completely ignore pesticides' harm to earthworms, springtails, beetles and thousands of other subterranean species.

Our study leaves no doubt that must change.

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For our analysis, conducted by researchers at the Center for Biological Diversity, Friends of the Earth and the University of Maryland, we looked at nearly 400 published studies that together conducted over 2,800 experiments on how pesticides affect soil organisms. Our review encompassed 275 unique species or types of soil organisms and 284 different pesticides or pesticide mixtures.

In just over 70 percent of those experiments, pesticides were found to harm organisms that are critical to maintaining healthy soils—harms that currently are never considered in the EPA's safety reviews.

The ongoing escalation of pesticide-intensive agriculture and pollution are major driving factors in the precipitous decline of many soil organisms, like ground beetles and ground-nesting bees. They have been identified as the most significant driver of soil biodiversity loss in the last decade.

Yet pesticide companies and our pesticide regulators have ignored that research.

The EPA, which is responsible for pesticide oversight in the U.S., openly acknowledges that somewhere between 50 percent to 100 percent of all agriculturally applied pesticides end up on the soil. Yet to assess pesticides' harms to soil species, the agency still uses a single test species—one that spends its entire life above ground in artificial boxes to estimate risk to all soil organisms—the European honeybee.

The fact that the EPA relies on a species that literally may never touch soil in its entire life to represent the thousands of species that live or develop underground offers a disturbing glimpse of how the U.S. pesticide regulatory system is set up to protect the pesticide industry instead of species and their ecosystems.

What this ultimately means is that pesticide approvals happen without any regard to how those pesticides can harm soil organisms.

To add to this, as principles of regenerative agriculture and soil health gain popularity around the world, pesticide companies have jumped on the bandwagon to greenwash their products.

Every major pesticide company now has Web materials touting its role in promoting soil health, often advocating for reducing tilling and planting cover crops. As general principles, both of these practices are indeed good for soil health and, if adopted responsibly, are great steps to take.

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However, pesticide companies know that these practices are often accompanied by increased pesticide use. When fields aren't tilled, pesticides are often used to kill weeds, and cover crops are often killed by pesticides before crop planting.

This "one step forward, one step back" approach is preventing meaningful progress to protect our soils. Pesticide companies have so far been successful in coopting "healthy soil" messaging because our regulators have demonstrated no desire or willingness to protect soil organisms from pesticides.

The long-term environmental cost of that failure can no longer be ignored.

Soils are some of the most complex and biodiverse ecosystems on the planet, containing nearly a quarter of the planet's diversity.

Protecting them should be a priority, not an afterthought.

Our research indicates that achieving this will require that we face the task of reducing the world's growing and unsustainable addiction to pesticide-intensive agriculture.

And it will require that the EPA take aggressive steps to begin protecting the health of our soil by addressing the well-documented harms of pesticides to our long-overlooked subterranean species.

This is an opinion and analysis article.

[scientificamerican.com](https://www.scientificamerican.com), 1 June 2021

<https://www.scientificamerican.com>

### Accumulating evidence suggests e-cigarettes are likely as harmful to the brain as regular smoking

2021-06-06

An ever accumulating volume of scientific and preclinical data shows new evidence of ways that e-cigarettes are dangerous. Understandably, most of the focus has been on the effects on the lungs, cardiovascular disease, and addiction. But recently, a growing body of scientific studies are starting to show the serious potential negative effects e-cigarette use may have on the brain.

Electronic-cigarettes (e-cigarettes), and more broadly electric vaporizers, have a history that goes back almost 100 years. The modern commercial version of the e-cigarette is usually attributed to the Chinese pharmacist

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Hon Lik, although numerous patents and related technologies developed by others were prevalent throughout the 1980's and 90's.

The immediate urgency in attempting to understand the health effects of e-cigarettes stems from their increasing rate of use, most concerning among young people. The challenge though is that they are simply too new, and not enough time has passed to understand and really appreciate their potential long term clinical effects due to sustained or chronic use.

Among high school students, the use of tobacco products had been on the decline until 1998, attributed to aggressive anti-smoking campaigns through the 90's. But this changed that year, with an increase in tobacco use due exclusively to the use of e-cigarettes. By 2014 e-cigarettes overtook all other tobacco products among this population. Even more concerning is the rate at which their use is increasing. According to the Centers for Disease Control and Prevention (CDC) e-cigarette use among high schoolers increased 77.8% in 2018 over 2017, with similar trends observed internationally.

And while it is possible to find e-cigarette pods and inserts that do not have nicotine, the vast majority do. What's worse, the trend has been to increase the concentration of nicotine delivered by these products. In the case of the popular Juul brand, the average concentration of nicotine considerably exceeds the concentration in regular cigarettes.

To be fair, one potential positive use of these devices might be in helping long time smokers reduce the use of regular cigarettes. The CDC has stated that that while e-cigarettes are not safe for people that don't use tobacco, they do have potential to benefit adult smokers. By triturating the chemical composition and rate of nicotine delivery, it may offer a new tool to assist these individuals. Getting a long time smoker to reduce their dependency on combustible cigarettes is a meaningful thing.

And a National Academies report concluded, "e cigarettes are not without risk, but compared to combustible tobacco cigarettes they contain fewer toxicants and are likely to be far less harmful than combustible tobacco cigarettes". The Federal Drug Administration (FDA) has stated that "nicotine is what addicts and keeps people using tobacco products, but it is not what makes tobacco use so deadly". Yet, at the same time, even within the FDA and CDC, they state that they continue to "investigate the distressing incidents of severe respiratory illness associated with use of vaping products". However, this does not necessarily imply that nicotine is responsible, but rather, that other additives and the delivery technologies themselves may be contributing to such clinical effects.

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## What is Currently Known About How e-Cigarettes Affect the Brain

When it comes to the brain, the potential dangerous effects e-cigarettes may have on the brain and their long term consequences stem from the well established effects nicotine in general has on the brain and brain development, the degree and concentration of nicotine e-cigarettes are capable of delivering, and the chemistry associated with how these devices deliver it. The microvascuature of the brain - the collection of specialized blood vessels that feed the brain and spinal cord and regulate their chemical environment - as well as the cells that make up the brain itself (neurons and other cells), are all vulnerable to damage.

The microvascuature of the brain and spinal cord consists of a vast collection of capillaries that provide brain cells with oxygen and nutrients. It also shuttles away cellular waste products. The brain's microvascuature is unique compared to the rest of the body. The endothelial cells that make up these tiny blood vessels form a regulated barrier between the blood on one side (the lumen side of the blood vessels) and the chemical environment the brain and spinal cord float in on the other side. This barrier is called the blood brain barrier.

The normal compliment of molecules and immune cells capable of moving between the blood and the cellular spaces in the other tissues of the body cannot freely do so with the brain and spinal cord - which collectively form the central nervous system. The unique chemical environment of the central nervous system formed by the blood brain barrier is the cerebral spinal fluid.

There is a strong correlation between long term smoking, cognitive decline in the later decades of life, and disruption of the blood brain barrier and microvascuature of the brain. In fact, cognitive decline and microvascular dysfunction are essentially universal consequences of long term smoking for everyone. The exact pathophysiological mechanisms involved are still not completely clear though, warranting continued research. But a recently published paper suggests how the negative physiological effects nicotine has on brain cells when delivered via e-cigarettes mirrors the effects observed with combustible cigarettes.

The endothelial cells that make up the microvascuature are particularly vulnerable. This means that the normal regulatory mechanisms responsible for maintaining the unique chemical environment of the cerebral spinal fluid via the blood brain barrier may slowly break down, contributing to cognitive decline.

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And in at least one mouse model study, the authors suggest that e-cigarettes may also have short term disruptive effects on cognitive and memory functions. So there may be more immediate and acute concerns with e-cigarette use, in particular in younger populations where the brain is still developing.

In another study, scientists found that e-cigarettes produce a stress response in neural stem cells, which are populations of cells that eventually become neurons and other important cell types in the brain. Again, potential effects on the still developing brain of adolescents is of immediate concern.

On a positive note, a clinically significant exception to the above effects is the use of nicotine to potentially treat Parkinson's disease. Nicotine and chemically related drugs have been shown to be effective in protecting the parts of the brain that are affected and degenerate in Parkinson's, as well as in treating the symptoms of the disease. Its use has also been indicated in reducing the significant side effects of other Parkinson's drugs.

At the moment there are more questions than answers when it comes to understanding the physiological and cellular effects e-cigarettes - and in particular high concentration nicotine delivery via these devices - has on the brain. The inclusion of additional additives may further exacerbate microvascuature and cellular damage to the brain. These risks should of course be balanced against e-cigarettes ability to help people quit combustible tobacco products, which for that population is judged to be significantly more dangerous than e-cigarettes. The long term epidemiological and public health consequences of e-cigarettes - both good and bad - will not be fully appreciated for years to come. But the data at the moment seems to suggest potential significant pathophysiological effects on brain function.

forbes.com, 6 June 2021

<https://www.forbes.com>

### Artificial intelligence could help biologists classify the world's tiny creatures

2021-06-04

With biodiversity in decline around the world, researchers are desperate to catalog all of Earth's insects and other invertebrates, which represent 90% of the 9 million species yet to be named. To do so, scientists typically face long hours in the lab sorting through the specimens they collected.

**The approach involves a robot, which plucks individual insects and other small creatures one at a time from trays and photographs them.**

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Enter DiversityScanner. The approach involves a robot, which plucks individual insects and other small creatures one at a time from trays and photographs them. A computer then uses a type of artificial intelligence known as machine learning to compare each one's legs, antennae, and other features to known specimens.

The technology then imposes a color code, or heat map, over the image (see above). The warmer the color, say, red, the more the computer program depended on that body part to make a call on the type of insect it was. This heat map makes it easier for researchers checking the identification to see what the program's "thought" process was.

The robot then moves each insect into a plate with 96 tiny wells, readying these specimens for DNA sequencing. The resulting species-identifying piece of sequence—a "DNA barcode"—is linked to the image in a database of all the cataloged specimens.

Although not quite as good as a human expert, the approach accurately classifies insects 91% of the time, the designers of the technology report in a study posted to the preprint server bioRxiv. That accuracy will improve as more specimens are added to the database, they note.

The researchers have made the software and 3D printing plans for the technology openly available. And, as the scientists describe in a second preprint, they have simplified the sequencing steps and software so that developing countries and small organizations can take advantage of it—96 insects at a time.

[sciencemag.org](https://www.sciencemag.org), 4 June 2021

<https://www.sciencemag.org>

### 11 children diagnosed with new form of ALS

2021-06-03

Six years ago, a teenager from Italy traveled to the U.S. in hopes of finding a diagnosis for her mysterious medical condition, which had caused her to lose the ability to walk and required her to have a breathing tube. Now, researchers have diagnosed the teenager, Claudia Digregorio, and 10 other children with a new form of amyotrophic lateral sclerosis (ALS) that strikes in childhood and progresses more slowly than what is typically seen with this condition.

In addition, the researchers have pinpointed a gene that seems to cause this form of ALS, and they may have also identified a potential treatment

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for the condition, according to a study describing the findings, published Monday (May 31) in the journal *Nature Medicine*.

"We hope these results will help doctors recognize this new form of ALS and lead to the development of treatments that will improve the lives of these children and young adults," Dr. Carsten Bönnemann, senior investigator at the National Institute of Neurological Disorders and Stroke (NINDS) and a senior author of the study, said in a statement. "We also hope that our results may provide new clues to understanding and treating other forms of the disease."

ALS is a rare disease that causes progressive degeneration and death of the nerve cells that control voluntary muscle movements, such as chewing, walking, talking and breathing, according to the NINDS. Most people with ALS develop symptoms between ages 55 and 75, and the disease usually progresses rapidly, with death occurring in three to five years after diagnosis.

But with the new form of ALS, symptoms appeared much earlier, often around 4 years of age. For many of the 11 patients, problems with walking and spasticity in their lower limbs were the first signs of the disease. By the teenage years, many of the patients, like Digregorio, required a wheelchair for mobility and a tracheostomy tube for breathing support. Before Digregorio left for the U.S., the then 15-year-old met with Pope Francis, who offered prayers for her health, according to a 2015 issue of the *NIH Record*, a newsletter of the National Institutes of Health.

The researchers found an answer for Digregorio, who was the first patient included in the study. Despite developing symptoms at such an early age, she and the other 10 children showed hallmark signs of ALS on neurological exams, including severely weakened or paralyzed muscles, the researchers said.

"These young patients had many of the upper and lower motor neuron problems that are indicative of ALS," said study lead author Dr. Payam Mohassel, a clinical research fellow at the NIH. (Motor neurons are nerve cells in the brain and spinal cord that send signals that control movement. Upper motor neurons originate in the brain and send signals to the lower motor neurons, which are in the spinal cord.) "What made these cases unique was the early age of onset and the slower progression of symptoms," Mohassel said. "This made us wonder what was underlying this distinct form of ALS."

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Using genetic sequencing, the researchers found that these patients had genetic changes in a specific section of a gene called SPLTC1. This gene is involved in the production of fats called sphingolipids, which are particularly abundant in brain tissue. A number of other deadly neurodegenerative diseases, including Nieman Pick disease and Tay-Sachs disease, are also caused by problems with sphingolipid metabolism.

Further research revealed that the mutation in SPLTC1 increased the levels of sphingolipids. Specifically, the researchers found that the mutation “takes the brake” off of an enzyme involved in the production of sphingolipids, meaning the body keeps churning out these fats without its usual feedback system to tell it when to stop.

The findings mean that restoring this “brake” might treat this type of ALS, the authors said.

In another experiment, the researchers tested a therapy called small interfering RNA, or siRNA, in which small strands of RNA work to “silence” a mutated gene — in this case, SPLTC1. In studies in lab dishes, the therapy worked to restore sphingolipids levels to normal.

“Our ultimate goal is to translate these ideas into effective treatments for our patients who currently have no therapeutic options,” Bönnemann said.

Future studies should also look into whether problems with sphingolipid metabolism play a role in other forms of ALS, the authors said.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 3 June 2021

<https://www.livescience.com>

### FDA has approved a new Alzheimer’s drug despite controversy over whether it works

2021-06-07

The U.S. Food and Drug Administration has approved a controversial Alzheimer’s treatment, the first that promises to slow the disease’s destruction in the brain, not just improve symptoms.

The drug, aducanumab, is also the first new Alzheimer’s treatment approved since 2003. It doesn’t cure or reverse Alzheimer’s disease, which affects more than 6 million people in the United States and is projected to affect nearly 13 million people by 2050.

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The drug’s path to approval hasn’t been smooth. In 2019, aducanumab was nearly scrapped after it appeared unlikely to succeed in two large clinical trials. But after reanalyzing more data that came in later, the drug’s developer, Biogen, which is based in Cambridge, Mass., saw signs that indicated the drug might work after all, and decided to pursue FDA approval (SN: 12/5/19).

Still, today’s decision concerns some doctors and scientists who see the FDA’s move as premature because they aren’t convinced that the drug, also known as Aduhelm, actually works. Approving a drug that’s not effective would set Alzheimer’s research back and offer patients false hope, those experts argue.

“This is a great day for Biogen and its shareholders, but a bleak day for the field of Alzheimer’s research,” says Michael Greicius, a neurologist at Stanford University. Pushing forward on the “illusion of progress,” he says, “will come at a cost to genuine progress in finding an effective treatment for this devastating disease.”

Others disagree that the evidence is slim, and are elated about having a new tool to fight a disease that has eluded an effective treatment for so long. “We have been waiting decades for this,” says neuroscientist Maria Carrillo, chief science officer at the Alzheimer’s Association in Chicago. A drug that delays decline due to Alzheimer’s promises patients and their families time “to sustain independence, to hold onto memories longer, to be with families longer,” she says. “That’s important.”

The drug, which is administered intravenously, is a lab-made antibody that targets small and large clumps of the sticky protein amyloid-beta. Some researchers suspect that in Alzheimer’s, A-beta scrambles connections between nerve cells and damages brain tissue, ultimately causing Alzheimer’s symptoms. But that idea, called the amyloid hypothesis, is still unsettled (SN: 2/25/11).

Brain scans reveal that aducanumab is effective at reducing A-beta in the brain. What’s less clear is whether this reduction comes with consistent improvements in people’s quality of life. That uncertainty led an FDA advisory panel to object strongly to the drug’s approval. In November, that group concluded that the evidence was too weak to show that the drug effectively treated Alzheimer’s (SN: 11/6/20).

Aducanumab comes with potentially serious side effects. Brain scans show that about 40 percent of people who received the highest dose of aducanumab in a clinical trial had swelling or bleeding in the brain. While



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most of those people had no symptoms, some had headaches, nausea and dizziness.

sciencenews.org, 7 June 2021

<https://www.sciencenews.org>

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### After 40 years of AIDS, here's why we still don't have an HIV vaccine

2021-06-04

Forty years ago, researchers described the mysterious cases of five gay men who had fallen ill with a pneumonia caused by the fungus *Pneumocystis carinii*. Two of the five men had already died.

That type of pneumonia usually affects only individuals who are severely immunocompromised, researchers wrote in the June 5, 1981 Morbidity and Mortality Weekly Report. Scientists would soon discover that a disease that would come to be known as AIDS was devastating the men's immune systems.

Three years later, scientists pinned the blame for AIDS on a virus dubbed HIV, or human immunodeficiency virus. Margaret Heckler, the then-U.S. Secretary of Health and Human Services, said in an April 1984 news conference that a vaccine to build protection against the virus would be ready to test within two years, holding out promise that protection was on its way.

We're still waiting.

Meanwhile, the HIV pandemic, which probably got its start in Congo in the 1920s, has led to devastating loss. More than 75 million people have been infected around the world as of the end of 2019. Approximately 32.7 million people have died.

That toll would undoubtedly be much higher if it weren't for advances in antiviral treatments that can prevent infected people from dying from HIV and from transmitting the virus to others (SN: 3/4/20; SN: 11/15/19). To date, only three people have beaten an HIV infection (SN: 8/26/20). For most, it lasts a lifetime.

That long-lasting infection is just one reason why no vaccine against HIV exists yet. It's also a tricky virus to pin down, with many variants and an uncanny ability to evade the immune system.

And money is an issue too. The lack of an effective HIV vaccine stands in stark contrast to COVID-19 vaccines that took less than a year to develop (SN: 11/9/20). For COVID-19 vaccine development, "the money poured in, which was the right thing to do," says Susan Zolla-Pazner, an immunologist at the Icahn School of Medicine at Mount Sinai in New York City. Funding for HIV vaccine research comes in five-year installments, making it difficult to allocate the money in an efficient way to get a vaccine off the ground.

**We're still waiting.**

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Still, that funding stream has allowed for advances in HIV research, which partly enabled the rapid success of multiple COVID-19 vaccines.

The technology behind Johnson & Johnson's COVID-19 jab, for instance, was first developed as a strategy to tackle HIV because it triggers a strong immune response (SN: 2/27/21). The shot uses a common cold virus that has been altered so that it no longer causes disease. That carrier delivers instructions to cells to make the viral proteins needed to train the immune system to recognize the invader. Johnson & Johnson's COVID-19 vaccine uses a virus called adenovirus 26; the first HIV vaccine candidates used adenovirus 5.

Unfortunately, a clinical trial to test the HIV vaccine showed that participants who had already been naturally infected with adenovirus 5 were more likely to become infected with HIV. Researchers halted the trial. They speculated that those participants were more susceptible to HIV because they already had immunity to adenovirus 5 and that dampened HIV-protective responses from the vaccine.

The absence of a good HIV vaccine is not for lack of trying, says Mark Feinberg, a viral immunologist who is president and CEO of the International AIDS Vaccine Initiative in New York City. "The work that's gone into HIV vaccine development has been by far the most sophisticated and creative."

### Complexities of HIV

Much of the difficulty in making a vaccine comes from the complex biology of the virus itself.

One major challenge is the immense genetic diversity among HIV viruses infecting people around the world. Much like the coronavirus, which has variants that are more transmissible or able to evade parts of the immune system (SN: 1/27/21), HIV has variants too. But "it's a completely different world for HIV," says Morgane Rolland, a virologist with the Military HIV Research Program at the Walter Reed Army Institute of Research in Silver Spring, Md.

That's because the virus makes new copies of its genetic blueprint at a dizzyingly fast rate, generating tens of thousands of new copies every day in a single person, Rolland says. Each of those new copies carries on average at least one unique mutation. Over the course of years, a single person can carry myriad variants in their body, though only a select few variants can be transmitted to others.

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The main problem these variants pose for vaccines is that some mutations are in parts of the virus that the immune system tends to attack. Such changes can essentially help the virus go incognito. Good vaccines must spark an immune response capable of handling that vast diversity to provide broad protection against infection.

What's more, the virus deploys multiple tactics to hide from the immune system. One tactic the virus uses is to cover parts of its surface in a dense layer of sugar molecules. Many of those surfaces would be the prime targets of immune proteins called antibodies that latch onto viral particles.

The body recognizes these sugars as "self," says Barton Haynes, an immunologist at Duke University School of Medicine's Human Vaccine Institute. "Basically, what the virus is saying to our immune system is 'Sure, you can make a protective immune response, go for it.'" But if the antibodies attack, they're seen as turncoats and are eliminated. That means the body can't fight the virus as effectively.

Perhaps the biggest hurdle, however, is the lifelong nature of the infection. Many viruses disappear from the body after the immune system fights them off. But HIV has the ability to insert its genetic blueprint into host DNA, establishing a hidden reservoir in immune cells called T cells, which normally fight infections (SN: 10/24/13). That reservoir makes the virus invisible to the immune system. Once the virus inhabits its new hideout, the immune system can't eradicate it, nor can drug treatments.

That means "you've got to have protective immunity there the day, the moment of transmission," Haynes says. "If [the immune system] doesn't get rid of the virus within 24 hours, the virus has won."

Most vaccines don't generate this type of sterilizing immunity that stops the infection from ever happening in most people who get the vaccine. Instead, shots are more likely to prevent people from becoming severely ill. Many COVID-19 vaccines, for instance, are highly effective at preventing people from developing symptoms, particularly severe ones. But some vaccinated people might still get infected with the coronavirus (SN: 5/4/21).

That's not an option with HIV since it never leaves the body, Zolla-Pazner says. "It's a very different bar that we have to jump over for an HIV vaccine."

### Testing HIV vaccine candidates

To date, there have been only a handful of clinical trials to test the efficacy of potential HIV vaccines in people. Of the six trials that scientists saw to

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completion, only one vaccine candidate proved effective at preventing infection.

That lone successful trial, known as RV144, used a “prime-boost” strategy in which participants received a total of six shots. The four “prime” jabs contained a canarypox virus that is incapable of replicating in cells and carries the genetic instructions for select HIV proteins. The participants’ cells make those viral proteins and develop an immune response against them.

Then participants also received two “boosts,” an injection of an HIV protein fragment that is essential for the virus to enter cells. The hope was that participants would develop a strong, wide-ranging immune response, giving those people broad protection against a variety of HIV subtypes.

Ultimately, that vaccine strategy lowered the risk of infection by 31.2 percent in vaccinated participants compared with the unvaccinated group. Although the shot showed only modest efficacy, those results changed the field by homing in on what type of immune response people needed to prevent infection, Zolla-Pazner says.

“Up until then, there was this raging debate about whether T cells or antibodies were most important in terms of protection,” Zolla-Pazner says. The results from RV144, first published in December 2009 in the *New England Journal of Medicine*, suggested specific antibodies were the crucial factor in reducing the risk of infection. “That’s not to say that T cells are not important — they are. But I think it established the primacy of antibodies,” she notes. If researchers could push people to make protective HIV antibodies, then perhaps a vaccine was within reach.

More recently, however, the canarypox/protein strategy has produced some less-promising results. In February 2020 — as COVID-19 was spreading around the globe — researchers stopped a follow-up trial being conducted in South Africa that used the same vaccine platform with the goal of improving on the RV144 finding (SN: 2/3/20). The results from the trial didn’t lower the risk of HIV infection in vaccinated people, researchers reported March 25 in the *New England Journal of Medicine*.

This is where more money for HIV vaccine research could have helped, Zolla-Pazner says. “If you had the money up front and you use it as needed... [scientists] would be doing science more efficiently and therefore getting the answers more quickly.” That investment is especially crucial for early animal testing. Instead of spending decades testing approaches on a handful of animals at a time to see if something works, an

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influx of money could support more robust experiments. And that could speed promising approaches into the arms of clinical trial volunteers.

## Making the right immune response

There are now hopeful signs that vaccine developers working on a variety of platforms might be on the right track to make an effective shot that provides sterilizing immunity. Still, “I don’t think at this point we should be taking any approach off the table,” says Zolla-Pazner.

One approach is tapping into the idea that some infected people naturally make antibodies capable of attacking a wide assortment of HIV variants and stopping those viruses from infecting cells (SN: 7/20/17). These antibodies take a long time to develop. Sometimes they don’t develop until years after an HIV infection has taken hold, Haynes says. HIV vaccine-makers want to speed up the process.

There are several ways to do that. One, being tested now in a clinical trial led by Johnson & Johnson, is to spark a broad immune response using an HIV protein composed of a mosaic of different HIV strains circulating around the world. Another way is to teach the immune system to make broadly neutralizing antibodies.

To do that, researchers identify broadly neutralizing antibodies in people infected with HIV. Then they can analyze the steps the body took to create those immune proteins. The goal is to craft a vaccine that tells vaccinated people to make similar antibodies when exposed to specific viral fragments, says Kevin Saunders, a vaccinologist at the Duke Human Vaccine Institute.

In a December 2019 *Science* study, Saunders, Haynes and their colleagues showed that in vaccinated mice and rhesus macaques, they could spur the first steps of HIV antibodies that might eventually become broadly neutralizing. A separate effort by Feinberg and his colleagues recently showed that 97 percent of human participants in an early-stage clinical trial made those same rare immune cells when exposed to a piece of HIV engineered to specifically generate the cells.

Other groups are focusing on T cells to fight infection. Louis Picker and Klaus Früh, for instance, developed a vaccine that causes specialized T cells to kill other T cells infected with HIV, rather than relying on antibodies to prevent infection entirely, the team reported in March in *Science Immunology*.

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The team had previously shown that around half of monkeys given the vaccine were protected. The animals became infected with SIV — the primate equivalent of HIV — but the virus couldn't replicate very well and over time the infection went away, says Picker, an immunologist at Oregon Health & Science University in Portland.

The next step is to move the vaccine into people. "Whatever we see in the clinical trial, it's breaking new ground," says Früh, a viral immunologist also at Oregon Health & Science University. "It's the first time this has ever been done so we're very excited about that."

After nearly four decades of trying, there is some light at the end of the tunnel. "I do believe we'll get a vaccine, I really do," Zolla-Pazner says. "But I don't know how long that's gonna take."

sciencenews.org, 4 June 2021

<https://www.sciencenews.org>

**What's nature worth?**

2021-06-01

WHAT'S NATURE WORTH? — Biodiversity is setting up to be the next big fight in sustainable investing, as financial companies, regulators and environmentalists act to protect natural landscapes on a global scale.

Following in the footsteps of greenhouse gas activism, which has countries and corporations mapping carbon footprints and trying to put the brakes on global warming, global leaders are redoubling efforts to stem plant and animal extinction that could upset ecosystems vital to clean air, water and raw materials.

While world attention is laser-focused on November's climate meeting in Glasgow, Scotland, G-7 climate and environment ministers are planning a big push for biodiversity at a summit in China in October, with a 10-year goal of conserving at least 30 percent of the world's land and oceans.

It took business leaders decades to join the climate fight, but now that they're on board with clean air, it might be easier to bring them on board with biodiversity protections.

"We are where climate was five to six years ago," said Chris Hart, a senior sustainable finance associate at environmental group Global Canopy. "People are seeing connections between the destruction of nature and

**"We are where climate was five to six years ago," said Chris Hart, a senior sustainable finance associate at environmental group Global Canopy.**

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how that might have a material impact on investments and lending. How do we measure that? This is where we run up against a dead end."

France's BNP Paribas Asset Management is partnering with reporting alliance CDP to develop biodiversity disclosure metrics for corporations. And the Taskforce on Nature-Related Financial Disclosures, or TNFD, a group that organized last June with the backing of the U.N., is aiming to put a value on nature so capital can be channeled to companies and investments that protect it.

Biodiversity isn't a new thing. What's new is the attention being paid. World leaders set goals a decade ago under the Convention on Biological Diversity, or CBD, but none were met by the deadline of 2020.

The pandemic has underscored the problem's urgency. Biodiversity loss and climate change are interlinked crises that have made humans more vulnerable to emerging diseases such as Covid-19, scientists say.

Any new framework will need strong accountability measures to track countries that are or aren't making progress in industries driving biodiversity loss, such as fishing, agriculture, mining and construction.

"What the CBD lacks is implementation and resources, as in finance and capacity building and human resources," said Li Shuo, a climate and energy campaigner at Greenpeace China. "It tells the world where it needs to be, but without answering how we actually get there."

Li wants China to take the lead on thorny political issues, such as helping persuade wealthy countries to help biodiversity efforts in developing nations such as Brazil and Argentina.

A rights-based approach for indigenous peoples who manage much of the world's forests and waterways also is key, said Guido Broekhoven, head of policy research and development at the nonprofit World Wildlife Fund.

But the U.S. isn't a party to the Convention on Biological Diversity. Congress never ratified it. A State Department official said the U.S. is "very engaged" and working closely with Canada, Japan, Australia, New Zealand, Norway and other allies.

President Joe Biden's plan to conserve 30 percent of U.S. land and water by 2030 is the administration's way of showing commitment to biodiversity, the official said.

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While negotiators negotiate, analysts are getting ahead of policy. They want to pinpoint private-sector contributions to biodiversity loss and how it could affect profits. It's a nascent effort.

politico.com, 1 June 2021

<https://www.politico.com>

### The brilliance of brown lawns: why your grass shouldn't always be greener

2021-06-02

Name: Brown lawns.

Colour: Brown, obviously.

Appearance: Much more lovely than you would imagine.

I don't think brown lawns are very lovely at all. Ah, I see. You seem to be someone who takes pride in their lawn. Uniform length, is it? Neat stripes? Well watered?

Of course it's well watered. Then you, my friend, are an enemy of the Royal Horticultural Society (RHS).

What do they hate me for this time? You waste too much water on your lawn. The RHS is urging gardeners to stop using mains water to keep their lawns green, on the basis that it is tremendously bad for the environment.

It is? Yes. Watering a lawn can use as much water in an hour as a person uses in a week. With the climate heating, England could face water shortages in as few as 25 years. Not spraying away hundreds of litres of the stuff on your lawn seems like a fantastic place to start.

But my lovely grass! It will grow back. You could just wait for it to rain and it will be green again in no time. Or, better still, invest in a water butt.

You don't understand. My lawn is my life. Well-maintained lawns are terrible things. They don't just suck up water; they are also ruinous for biodiversity.

Really? Yes. In 2019, the World Economic Forum's Global Risks Report named biodiversity loss as one of the biggest threats to the future of humankind.

OK, fine, what should I do? You could let your lawn grow out a little. Even slightly longer grass is terrific for pollinators, plant diversity and absorbing

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greenhouse gas emissions. Plus, if you disturb your grass by mowing it, you are wildly increasing the likelihood of pest and weed invasions.

Long brown grass. My neighbours will be so jealous. Another plan would be to create a patchwork lawn. This is where you dig up your lawn entirely and replace it with beautifully coloured pockets of low-growing (and mowable) plants such as marjoram, clover, camomile, buttercups and fleabanes. Google them. They are stunning – and much better for the environment.

That does actually sound quite nice. And it will massively reduce the amount of time you spend tending to your garden, leaving you with more time to be around your family.

I've gone off the idea again. Fair. In that case, just buy a water butt.

Do say: "Brown grass is a sign of a healthy garden."

Don't say: "Are giant, knackered trampolines also a sign of a healthy garden?"

theguardian.com, 2 June 2021

<https://www.theguardian.com>

### Will the U.S. ban PFAS in food packaging?

2021-06-03

Since they were developed around the middle of last century, PFAS have been hailed by multiple industries as miracle chemicals. Not only could they stop rain from soaking through fabric, but they could also prevent eggs from sticking to pans and repel grease that would otherwise seep through fast food wrappers.

In short, they have made eating more convenient, but a growing body of science suggests that PFAS, or per and polyfluoroalkyl substances, are toxic and linked to serious health problems, and chemical companies have hidden internal science showing their dangers.

In recent years, testing has found the chemicals in a range of foods, but the U.S. Food and Drug Administration (FDA) continues to allow companies to use PFAS in food packaging, cookware, and processing equipment.

That could soon change. A new piece of legislation that will likely be introduced in the coming weeks by Representative Debbie Dingell

### Well-maintained lawns are terrible things.

**"We know that PFAS builds up in your blood, it damages health, it causes cancer, and it's a really dangerous chemical," Dingell told Civil Eats.**

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(D-Michigan) would largely enact a federal ban on the chemicals' use in food production and packaging.

"We know that PFAS builds up in your blood, it damages health, it causes cancer, and it's a really dangerous chemical," Dingell told Civil Eats. "And most people don't realize that it's in their food containers."

PFAS are a class of 9,000 compounds dubbed "forever chemicals" because they don't ever fully break down in nature. They are typically used to make products water-, stain-, and grease-resistant. They're so effective that they're used across dozens of industries in everything from cosmetics to waterproof clothing, Scotchgard, and firefighting foam. Their ubiquity has led to contamination of drinking water supplies for more than 110 million people nationwide.

Until 2020, PFAS were also in every "biodegradable" molded fiber packaging product, including the clam shells commonly used at restaurants such as Chipotle and Sweetgreen. They're also regularly used in food wrappers, paper plates, and paper straws, among other products. It's difficult to differentiate between paper products coated with PFAS and those coated with bioplastics, but the latter don't contain the chemicals.

Research has shown that the compounds can leach into food, while PFAS researchers at the Silent Spring Institute found an association between elevated levels of the chemicals in humans and increases in the number of meals eaten outside the home. There's now growing consensus that lawmakers must act to get PFAS out of food.

"There are so many ways that we're exposed to PFAS, but our food is probably the primary route of exposure," said Scott Faber, legislative director for public health advocate Environmental Working Group. "Unfortunately, the FDA has for too long ignored the risks of PFAS, even though their dangers are well documented and well understood. So, Congress must act because the FDA has simply failed to do so."

Federal regulators allow companies to claim the chemicals' use as a trade secret, so there's little public information about which products contain them. But independent analyses have revealed how widely they're used. Recent testing of more than 300 fast food sandwich wrappers, pastry bags, French fry bags, pizza boxes, and other paper and paperboard packaging found fluorine, a marker of PFAS, in 40 percent of samples. Similarly, a 2017 Toxic Free Future study detected their likely use in 13 percent of grocery stores' deli and bakery packaging, and testing found fluorine in all molded fiber products.

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Beyond carryout food packaging, PFAS can also be found in the packaging that holds items ranging from microwave popcorn to salami. They're used as lubricants in the machinery that produces packaging, which unintentionally leaves traces of PFAS. They're also commonly found in baking supplies, such as parchment paper. And the nonstick coatings on frying pans, crock pots, panini presses, aluminum foil, and more often contain PFAS.

The chemicals' widespread use in the food industry frustrates Maricel Maffini, an independent researcher who studies PFAS in food packaging, because good alternatives are increasingly available.

"A valid question is, 'Do we really need to use this type of toxic, persistent chemical in food packaging? Is that an essential use?' I would say it's not," she said.

'It Will Move'

Rep. Dingell's bill, called the Keep Food Containers Safe From PFAS Act, is her second attempt at a ban on the chemicals' use in food contact surfaces. A 2020 bill of the same name was one of more than 100 pieces of PFAS legislation introduced in Congress last session that would've enacted limits on the compounds' use, and nearly all failed amid intense opposition from the chemical industry.

The broadest of them was the PFAS Action Act, which had bipartisan support in both chambers; it was passed in the House by a wide margin but filibustered in the Senate. The Trump administration had promised a veto.

Its failure highlights the difficulty in moving PFAS legislation past industry allies in Congress, but the political environment is friendlier this legislative session as Democrats control both chambers and President Joe Biden has called for stricter regulations.

"It's a different time, different place, people care, and it will move," Dingell said. "I'm hopeful that with a Democratic administration and an EPA administrator who recognizes the chemicals' danger, we will get this through."

Though Republicans in the Senate could again use a filibuster to stop legislation, Faber and Dingell say that there is now a greater sense of urgency around the chemicals' use than there was just a few years back.

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“There is literally no chemical that’s getting more attention by legislators than PFAS, so, regardless of party, they’re aware and concerned that PFAS is building up in the blood of millions of people,” Faber said.

One of Congress’ few PFAS successes last session was a ban on their use in military food packaging that was included in the National Defense Authorization Act. States have also taken action in the absence of federal legislation, with Washington, Vermont, New Hampshire, and Maine passing PFAS bans. Similar bills have momentum in Connecticut and California and have been introduced in about 10 other states.

Meanwhile, restaurant and grocery chains that collectively represent nearly 80,000 stores, including Chipotle, Wendy’s, Whole Foods Market, and McDonald’s, have removed or committed to limiting PFAS in their products. Food packaging companies have begun to do the same.

The market movement and state laws are key to success in passing a federal ban, Faber said. “Oftentimes, Congress will act to bring consistency instead of winding up with inconsistent laws,” he added.

### ‘Not an Easy Fix’

A federal PFAS ban would accelerate the already growing demand for alternatives, but finding replacements is a time-consuming and costly undertaking.

In 2016, the Biodegradable Products Institute (BPI), a nonprofit that certifies packaging as compostable, began internally discussing whether it should stop certifying plant-based products made with PFAS. The rationale: It was contaminating compost streams.

The discussion spurred development of alternatives among compostable packaging manufacturers such as World Centric. “It’s a difficult issue—not an easy fix,” said Aseem Das, founder of World Centric, which has spent more than a year experimenting with PFAS substitutes.

PFAS made it easy to manufacture World Centric’s molded fiber products: It added PFAS to a slurry that was formed into the bowl or product, providing water, grease, and heat resistance. For its PFAS-free products, World Centric had to change its approach to incorporate a 100 percent plant-based spray coating that’s applied post-production.

Developing the coating was one challenge, and changing the manufacturing process was another because it requires more steps and cost. It took World Centric about a year of manufacturing trials, pilot

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production, adjusting machinery, and generally ramping up its output to be able to produce millions of PFAS-free products to meet demand.

Once the products are ready for full production, the changes then must be made at the multiple manufacturing facilities with which World Centric works. While some molded fiber bowls in its catalog are already made without PFAS, about 90 percent of its products will likely be PFAS-free by the year’s end. Das wouldn’t disclose what’s in the alternative but said it’s 100 percent plant-based.

BPI now certifies World Centric’s PFAS-free molded fiber products as compostable. The challenges the company faced to find a replacement are common, said BPI executive director Rhodes Yepsen. Besides providing a grease and water barrier in molded fiber packaging, PFAS also allows moisture to escape, which prevents food from getting soggy. For that reason, Yepsen said, PFAS “is a hard one to replace.”

BPI has recently tightened up its certification protocol and is better prepared to identify potentially problematic chemicals, Yepsen added.

Among the alternatives are bioplastics and waxes. And while Das noted that World Centric is using FDA-approved ingredients, public health advocates like Maffini cautioned that little is known about the safety profiles of the alternatives. Meanwhile, the FDA won’t make that information public either, as most companies are allowed to claim new formulas as trade secrets.

That’s created some uncertainty about whether the agency is protecting the public, Maffini said. “I hope that they’re learning from the PFAS story.”

civileats.com, 3 June 2021

<https://www.civileats.com>

### Why do mosquitoes buzz in our ears?

2021-06-01

Nothing feels more like summer than a neighborhood barbecue, especially following the dreary winter months. But the nemesis of summer gatherings remains: the droning whine of mosquitoes around our ears.

So, why do these bloodsucking insects hover around our ears in the first place? And why do they produce that annoying buzz?

“The buzzing in your ear is mostly just a side effect of the mosquito’s wings beating,” said Michael Riehle, a professor of entomology at the University

**“[The sound] doesn’t have a long range, so you notice it most when they are flying around your ears.” PUND**

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of Arizona. “[The sound] doesn’t have a long range, so you notice it most when they are flying around your ears.”PUND

### Ladies that lunch

That buzzing you hear is likely from a female mosquito. That’s because male and female mosquitoes lead very different lives. The males typically hang out and sip on the nectar of flowers; they couldn’t care less about the humans lumbering about. The females, however, need to find a blood meal after mating in order to have enough energy to produce eggs. In fact, female mosquitoes are equipped with unique tools to home in on their next victim.

“From a distance, [female mosquitoes] cue in on carbon dioxide that we exhale in conical plumes from our bodies,” Riehle told Live Science. “The carbon dioxide stimulates the female mosquito to start host-seeking, flying back and forth to follow that concentration gradient back to the source.”

In other words, mosquitoes buzz around our heads because that’s where we expel the most carbon dioxide.

As she approaches, the female mosquito zeros in on body heat and the carbon dioxide plume to land on the victim. The female mosquito uses taste sensors on her feet to determine whether the human, or any blood-bearing animal, is adequate to tap for her next meal. While some studies suggest that type O blood is the best vintage, Riehle remains skeptical; he has not found any convincing research about blood type and mosquito interest. Instead, he believes that other factors, like a person’s genetics and even diet, play a bigger role in how “delicious” a person tastes.

Your skin is “giving off this unique cocktail of scents that is going to be more attractive to some mosquitoes than to others,” Riehle said. Another study found that female mosquitoes were more attracted to men who had less diverse bacteria on their skin than to men with more diverse skin bacteria; these blood suckers are also partial to people who wear dark colors, such as black.

As the female flies toward a target, she beats her wings approximately 500 times per second at a frequency of 450 to 500 hertz. This frequency is pitched to the musical note A, which, coincidentally, is what an orchestra tunes itself to before a concert.

While this sounds like a high-pitched drone to us, it is music to male mosquitoes. In fact, males, whose wings beat at a higher frequency than

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the females; listen for the dulcet tones of females when they are searching for mates. Riehle likes to demonstrate this effect to his students by passing a tuning fork pitched to A over a cage of female mosquitoes. In every test, the females do not react, he said. The same demonstration over the cage of male mosquitoes sets their wings in a flurry as they frantically search for the goddess who created those sweet, sweet vibrations.

While male mosquitoes go wild for this tone, humans are less thrilled to hear it. But while we may readily perceive mosquitoes buzzing around our ears, Riehle noted that most mosquitoes are not attracted to our heads. Rather, these bloodsuckers may be more inclined to seek out our feet, which sport bacteria that give off mosquito-enticing aromas. However, most people probably don’t notice a mosquito buzzing around their ankles, he said.

A 1996 study in the journal *Trends in Parasitology* found that female mosquitoes from the genus *Anopheles*, which are responsible for transmitting the malaria parasite, were attracted to the bacteria on human feet. This bacterium, *Brevibacterium linens*, is the same one that gives Limburger cheese its distinctive smell. A follow-up 2013 study in the journal *PLOS One* confirmed that mosquitoes are, in fact, attracted to Limburger cheese.

As for avoiding mosquitoes, your best bets are to wear clothing that is light-colored and long, apply insect repellent and steer clear of mosquito hotspots (wetlands, for example) at dusk and dawn, when mosquitoes are most active, Live Science previously reported.

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[livescience.com](https://www.livescience.com), 1 June 2021

<https://www.livescience.com>

### An Australian inventor wants to stop global warming by electrifying everything

2021-05-28

AUSTINMER, Australia — During a TED talk, Australian inventor Saul Griffith wanted to show his audience how much a person’s individual choices can affect the planet.

The person, in this case, was himself.

**“I really thought I was the leader of the environmental movement. I was not,” he said. “I was doing bad things to Gaia.”**



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And so, the tall engineer with tousled brown hair pulled up a chart on a big screen behind him on the stage.

On display was an exhaustive audit of his personal energy impact, calculating the carbon footprint of every action in his life down to his underwear, toilet paper and taxes.

The founder of a wind power company and a dedicated bicycle commuter, Griffith was ashamed to discover that he was consuming much more power than the average American.

In short, a planet hypocrite, he told his audience.

"I really thought I was the leader of the environmental movement. I was not," he said. "I was doing bad things to Gaia."

Since that TED talk 10 years ago, Griffith's San Francisco lab has attracted \$100 million in capital from investors and spun out a dozen companies.

The 47-year-old, who won a MacArthur "genius" grant in 2007 for his prodigious inventions "in the global public interest," from novel household water-treatment systems to an educational cartoon series for kids, has spent the past decade working to solve climate change through technology.

His solution: mass electrification.

While most environmentalists have taken aim at the fossil fuel industry, Griffith wants to decarbonize each American household — replacing every gas cooktop, furnace and hot water heater with electric devices. Otherwise, he says, efforts to reach net-zero carbon emissions will fall short.

Most of Griffith's tinkering happens in a nearly century-old former factory in San Francisco's Mission District. Organs were once assembled here and lowered to street level through a giant trap door in the wooden floor.

Now, the organ parts left behind have been crafted into benches, tables and a skateboard rack. Old organ chimes hang from the walls above the main workspace. The three-floor, narrow, 24-foot-wide, 6,000 square-foot building's architecture predates modern building codes, with perilously steep staircases winding up to Griffith's top-floor office.

From every available space on the ceiling and walls, Griffith's team has hung bicycles — from cargo bikes to a four-seater electric model.

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Otherlab, which Griffith co-founded more than a decade ago, is where the Australian and two dozen other scientists are trying to find a way to stop global warming.

One of the lab's current projects aims to radically redesign offshore wind platforms. Another team is designing a solar-powered scooter set for launch this year. They also designed a tracker system that helps solar panels follow the sun's path through the day.

"Things don't stay on paper very long," said Joanne Huang, Otherlab's special projects lead, who joined the company in 2019. "It is like a build-it-and-see kind of place. It's very fun in that way."

Where many environmentalists focus on a gloomy outlook for the planet, Griffith believes climate change is solvable, and he imagines a cleaner future that looks better than what we have now.

"Most environmental groups are still telling the story that if we try really, really hard, life is only going to suck a little bit less than it would otherwise," he said in an interview. "There is every reason to believe the future can be awesome!"

In the first-floor workshop, Huang and Hans von Clemm, an engineer, were recently working on modular cubes designed to stack neatly in the corner of a person's garage to store excess energy from rooftop solar systems. The heating and storage systems are being tested in several homes in California, including Huang's. Their hope is to store electricity from rooftop solar panels for far less than the cost of a lithium battery — making the technology accessible to more people.

"When Saul is doing development, he is trying to understand: 'How can I make the biggest impact, and how can I involve the most people? How can I address the people that new technology doesn't normally get to?'" Huang said.

Otherlab's projects have received grants from the U.S. Energy Department's advanced research lab, the U.S. Navy and NASA.

For the task, Griffith has assembled an eclectic team. Von Clemm is a former ski instructor; Huang was a competitive snowboarder.

Von Clemm, who joined Otherlab as an intern in 2016, remembers the day he interviewed for the job. Griffith asked to see his hands, which were calloused and covered in cuts. The week before, von Clemm had been building a knife drawer for his mom. "All right," Griffith said approvingly.

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He then handed the young engineering student a piece of paper and a pen and asked him to draw a working bicycle in 60 seconds. Von Clemm said his hands were shaking. When he finished, Griffith declared: "Okay, you can start tomorrow."

Griffith's vision for addressing the devastating impact of climate change bucks tradition. Instead of just focusing on shutting down coal and gas-fired power plants and polluting industries and switching to renewable power generators, he wants to also focus on suburban life.

Switching to more renewable energy sources, such as wind power, and solar are important, he said. But there is little use in having wind or solar power if your stovetop, furnace and water heater are powered by gas.

Griffith acknowledges this could be a tough task — furnaces are not easy to swap out like appliances such as refrigerators: Typically, you replace them only when they are broken. Clean technology for households has not kept up with the strides made in the renewable energy industry in the past decade, he says.

"We need a Cambrian explosion of local experiments of how to locally solve the problem" said Griffith, whose book, "Electrify: An Optimist's Playbook for Our Clean Energy Future," will be published in October.

"Solving climate change should taste at least as good as carrots, at best ice cream, but it should not be painful," he writes.

Households are a big source of emissions, Griffith says, and unlike previous energy crises, this is not a problem that can be solved by turning down the thermostat and buying Energy Star appliances. It requires complete replacement of household fossil fuel appliances.

"Saul's ideas challenge status quo thinking in some climate circles, mine included, and I think that is good for the broader dialogue," said Joseph Majkut, director of climate policy at Washington think tank the Niskanen Center.

Still, some experts — while sympathetic to Griffith's efforts — favor solutions such as carbon pricing that put markets to work.

"I appreciate and admire Griffith's creativity," said Michael Greenstone, director of the Energy Policy Institute and Becker Friedman Institute at the University of Chicago. "However, I think the urgency of the climate crisis requires that we ruthlessly search for the least expensive reductions in CO<sub>2</sub>, rather than those that might be possible no matter the cost."

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Griffith retreated to Australia during the pandemic and is monitoring progress at his California lab through video chats.

He is also running experiments on his own home, south of Sydney. He built a six-foot-tall cedar-clad hot tub in his yard to store the excess electricity from experimental solar panels covering his home. He could have bought a water tank for the job, but a hot tub is more fun.

For an inventor who is happiest with a tool in his hand, Griffith said he is spending an awful lot of time behind a computer these days. In his study, a series of vibrantly colored sketches — like illustrations in a children's book — map out what he believes Americans will need to replace to stop climate change.

Walking around his yard he pointed out the lawn mower that he says can be electrified. He has a collection of old cars, from a 1960s Fiat minivan to a gas-guzzling Lincoln Continental, all of which he plans to convert to electric, starting with the Fiat, which is in a shop in San Francisco. There is still room in his plan for backyard tinkerers and mechanics.

He grew excited as he talked about the possibilities, every adult toy — boats, Jet Skis, vintage cars — that could be electrified and double as batteries when not in use.

The foundations for Griffith's environmentalism were laid in childhood. When Griffith and his sister were growing up, family vacations were spent traveling the continent in an old Land Rover stacked with photography equipment, visiting remote islands and swimming with turtles. His mother is a wildlife artist and printmaker, his father a retired professor.

"We were always aware of social issues," he said. His mom, Pamela Griffith, was an early feminist and Greenpeace activist, donating her art to save the whales. His father, Ross Griffith, was a director of a nonprofit charity for disadvantaged children, helping establish a multimillion-dollar business turning unwanted used clothing into fabrics for heat and sound insulation.

As a graduate student at Massachusetts Institute of Technology, where he earned a Ph.D. in 2004, Griffith and another student created Howtoons — a comic series that teaches children to transform everyday objects into simple inventions, including electric motors. In one cartoon, a boy imagines a future where he could travel to school by zip line — a pulley suspended on a cable connecting two poles — avoiding the "big ol' stinking school bus of yesterday."

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“Even then I recognized him as an unconventional thinker, full of world-changing ideas,” said Shuguang Zhang, one of his professors at M.I.T. “Saul started to think of personal impact on energy early before it ever entered most people’s consciousness.”

Not all of his ventures have been successful. In 2006, Griffith co-founded a kite-powered wind-energy company called Makani Power, based at an old naval air station in San Francisco Bay. The idea was to build giant kites that could fly high enough to reach the strongest, steadiest winds, producing more reliable power.

Unfortunately for Makani’s backers, the cost of producing energy from conventional turbines fell sharply, as more and larger turbines came onto the market. Makani’s kites could not compete. Google X, which acquired the company in 2013, shut it down in 2020.

It offered a valuable lesson for Griffith on the importance of scale: “There are two ways to reduce the cost of energy. One is inventing the better mousetraps; the other is producing mousetraps in gob-smacking quantities.”

A turning point in his thinking was an Energy Department study that Otherlab was contracted to do in 2018.

Griffith has been obsessed with energy data for two decades: “Every engineer wants to know how the machine works.” But by taking a deeper dive into historical energy use patterns, Griffith said, the team made a startling discovery: The United States, they believed, could reach its climate goals and consume less than half the energy it does now without forcing Americans to downsize their homes or cars, take public transit or become vegan. And the way to do it was to electrify everything.

Last year, Griffith started a policy group called “Rewiring America” to push the idea of mass electrification. They have been talking to lawmakers in Washington, including Sen. Martin Heinrich (D-N.M.) who introduced a resolution in the Senate on May 18 that is inspired by Griffith’s ideas and calls for widespread electrification of American homes and businesses and new financing to help pay for it.

The technology “is already there” to support mass electrification. The country needs investments, industry cooperation and workforce training to help the effort succeed, Heinrich said at a news conference.

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Back in Australia, Griffith gazes out the window each morning and counts the solar cells on roofs in his neighborhood. Two more homes started their installations in early April.

He has done the math on what is needed to reach his goal in America: There are about 250 million gasoline-powered cars to electrify, some 90 million rooftops to fit with solar panels and about 120 million households with gas hot water heaters and furnaces that need replacing. And, because a big part of the solution is in your driveway, on your roof and in your basement, he said, his electrification plan could create jobs in every U.S. Zip code.

“I’m a scientist, engineer, inventor and father who wants to leave my kids a better world,” he said. “The data convinces me that it is still rational to have hope.”

washingtonpost.com, 28 May 2021

<https://www.washingtonpost.com>

### Nature isn’t really healing

2021-05-30

As the coronavirus pandemic took hold last spring and people around the world went into lockdown, a certain type of news story started to spring up—the idea that, in the absence of people, nature was returning to a healthier, more pristine state. There were viral (and fake) reports of dolphins in the canals of Venice, Italy, and pumas in the streets in Santiago, Chile. But new research shows that the true effect of suddenly removing people from so many environments has turned out to be much more complex.

“It was surprising how variable the responses were,” says Amanda Bates, an ecologist at Memorial University, in Newfoundland and Labrador, who led an international team of more than 350 researchers in an effort to study how lockdowns have affected the natural world. “It’s impossible to say,” Bates says, whether the consequence of people’s sudden disappearance “was positive or negative.”

The team collected and analyzed data from hundreds of scientific monitoring programs, as well as media reports from 67 countries. As many would expect, it did find evidence of nature benefiting from the sudden drop in air, land, and water travel.

**“It’s impossible to say,” Bates says, whether the consequence of people’s sudden disappearance “was positive or negative.”**

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Wildlife also benefited from reduced air and noise pollution as industry, natural-resource extraction, and manufacturing declined. There was less litter found on beaches and in parks, and beach closures in some areas left the shoreline to wildlife. In Florida, for example, beach closures led to a 39 percent increase in nesting success for loggerhead turtles. Ocean fishing fell by 12 percent, and fewer animals were killed by vehicle strikes on roads and in the water. Ocean noise, which is known to disrupt a variety of marine animals, dropped dramatically in many places, including in the busy Nanaimo Harbour, in British Columbia, where it fell by 86 percent.

But there were also many downsides to the lack of humans. Lockdowns disrupted conservation-enforcement and research efforts, and in many places illegal hunting and fishing increased as poor, desperate people looked for ways to compensate for lost income or food. The ecotourism activities that provide financial support for many conservation efforts dried up, and many restoration projects had to be canceled or postponed. Parks that were open to visitors were inundated by abnormally large crowds. And in many places, hikers expanded trails, destroyed habitats, and even trampled endangered plants.

The researchers estimate that delays to invasive-species-control programs caused by lockdowns will have a huge impact. Failure to remove invasive mice from remote seabird-nesting islands could lead to the loss of more than 2 million chicks this year alone.

The scale of these negative impacts was unexpected, Bates says. "I thought we were going to see more positive impacts," she says, adding that it highlights just how much some ecosystems depend on human support to keep them viable. "I don't think some of these systems would be persisting without our intervention."

And some of the changes led to complex cascades, where it was difficult to disentangle the positive from the negative. Snow geese, for example, are usually hunted, to stop them from feeding on crops during their northward migration across the United States and Canada. But this year they faced less hunting pressure, and so arrived in the high Arctic larger and healthier than usual, according to hunters in Nunavut. It might be good for the geese, but they also graze fragile Arctic tundra and degrade the habitat for other species, so more geese will have knock-on effects on the rest of the ecosystem that could persist for years.

As the world slowly gets back to normal, the data collected during this time of disruption will be useful in developing more effective forms of conservation that take into account all the ways that humans influence

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their surroundings, says Rebecca Shaw, the chief scientist for the World Wildlife Fund. "The cool thing will be to watch how these responses change over time as human mobility gets back to normal, and to use the information to better design conservation actions to increase biodiversity both near and far, away from human populations," she says.

Alison Woodley, a strategic adviser at the Canadian Parks and Wilderness Society, agrees. She says the positive impacts that were seen are likely to be temporary shifts, and so finding ways to develop more resilient conservation systems will be vital. "The common thread is the need for long-term, stable, and adequate funding to make sure that conservation is resilient and that the positive aspects of conservation are overcoming the negative," she says.

That will benefit not just nature, but humans as well, Woodley says. There is a growing realization that protecting nature offers our best defense against future pandemics, by reducing the contact and conflict between humans and animals that can lead to viruses jumping from one species to another.

"Preventing future pandemics and restoring our life-support system requires decisions and management by people to protect large areas of land and ocean, and to sustainably manage the rest of the landscape. And to do it in an integrated way," Woodley says.

[theatlantic.com](https://www.theatlantic.com), 30 May 2021

<https://www.theatlantic.com>

### What's the biggest freshwater fish in the world?

2021-05-31

It took three biologists to haul a 240-pound (109 kilograms) fish out of the Detroit River in Michigan last month. The nearly 7-foot-long (2.1 meters) "monster" sturgeon, caught and released by the Alpena Fish and Wildlife Conservation Office, could be more than 100 years old. It's a mightily impressive catch for sure, but is it the biggest freshwater fish in the world?

The Detroit River fish is a lake sturgeon (*Acipenser fulvescens*), and while it is believed to be one of the largest ever caught in the U.S., there are much bigger fish swimming in rivers around the world. According to the U.S. Geological Survey, the planet's largest freshwater fish is the beluga sturgeon (*Huso huso*), living between Europe and Asia in the Black, Azov and Caspian seas, and the rivers feeding them.

**It's a mightily impressive catch for sure, but is it the biggest freshwater fish in the world?**

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Beluga sturgeon can reach a maximum length of more than 26 feet (8 m), or about four times as long as a king-size mattress, and weigh up to 2.2 tons (2,000 kg, or 2 metric tons), according to the Pan-European Action Plan for Sturgeons, prepared by the World Sturgeon Conservation Society and World Wildlife Fund. When they grow up, belugas are at the top of the food chain, eating fish such as roach and carp, aquatic birds and even seals, according to the International Union for Conservation of Nature (IUCN).

Belugas can live more than 100 years, like lake sturgeon, which gives them plenty of time to grow. "If you live a long time, you've got a lot of time to eat," Phaedra Doukakis, a fishery policy analyst at the National Oceanic and Atmospheric Administration (NOAA), told Live Science. [PLAY SOUND](#)

Sturgeon have existed for more than 250 million years and even lived alongside the dinosaurs. The beluga is the biggest of the 27 sturgeon and paddlefish species alive today.

Apart from their long lifespan, it's difficult to say exactly why belugas grow so big. Larger sturgeon individuals probably had greater reproductive success, perhaps because the females can generate more eggs than smaller female fish. Their vast size could also help them catch prey and survive predation interactions, according to Leonardo Congiu, an associate professor of ecology at the University of Padova in Italy.

However, today's beluga sturgeon may not be reaching lengths upward of 23 feet (7 m). "I don't think there are beluga of that size any more," Congiu told Live Science in an email. "The species is under great pressure due to poaching, and probably the large animals have all been caught."

Congiu and his colleagues published a paper in January 2021 about the distribution and genetic diversity of beluga populations in the journal *Diversity and Distributions*. They aim to reintroduce the fish into Italian rivers, after it became locally extinct due to overfishing and the construction of dams in the country.

Beluga sturgeon are listed as critically endangered on the IUCN Red List of Threatened Species, the category for species most at risk of extinction. Adult females are prized for their fish eggs, which are sold as caviar and valued at more than \$3,500/lbs. (\$8,000/kg), according to the IUCN.

Doukakis, who is also co-chair of the IUCN Sturgeon Specialist Group, thinks it's possible that there are 23-foot-plus belugas out there, but they would have a significant bounty on their heads. "An old female that

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achieved that kind of a length could be loaded with caviar and could be a very, very expensive, very lucrative fish to poach," she said.

Sustainably farmed caviar is now available, but Doukakis explained that even if maximum protections were put in place for wild beluga sturgeon, it would take a long time for younger individuals to mature and reach their maximum lengths.

The title for biggest growing sturgeon today may actually belong to the white sturgeon (*Acipenser transmontanus*), the largest sturgeon in the U.S. In fact, people are probably more likely to see more large white sturgeon than beluga sturgeon, just because white sturgeon are probably better protected, Doukakis said.

For now, white sturgeon are not threatened with extinction and their population is stable, according to the IUCN. However, like almost all sturgeon species, they are threatened by the construction of dams. Dams prevent sturgeon from swimming upstream to reach their spawning grounds and also alter the environmental conditions of the rivers that sturgeon rely on, according to Doukakis.

Beluga and white sturgeon are called freshwater fish because they are born in freshwater and use it for breeding, but they also occupy saltwater environments. Doukakis preferred to call them freshwater-dependent fish to distinguish them from species that spend their entire lives in freshwater.

What about the biggest fish that only live in freshwater? The Mekong giant catfish (*Pangasianodon gigas*), native to the Mekong river in Southeast Asia, holds that record. These catfish can grow to 10 feet (3 m) long and have previously been caught weighing 646 lbs. (293 kg), Live Science previously reported. Like beluga sturgeon, these fish are also considered critically endangered by the IUCN, due to dams and overfishing.

Originally published on Live Science.

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

<https://www.livescience.com>

### Why we should be turning former mines into trails

2021-05-29

Desire to be on public land is skyrocketing right now, and nowhere is that more true than the mud-season mecca of Moab, Utah. Last week, I—along with everyone else in a 12-state radius—rolled into town looking to lizard

**The site was abandoned after the test, reclaimed by the Army in the early 2000s, and turned into trails in 2018 as part of the city's plan to attract tourists.**

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myself in the sun and avoid falling off my bike. Instead, we found jammed trailheads and the constant drone of ATVs.

Crowded out and COVID-stressed, I headed north. Less than an hour from the churn of Canyonlands National Park, just outside the town of Green River, I had the Athena Trail to myself. It was completely quiet except for the whir of my cassette and the huff of my own breathing, my bike rolling over the slickrock and striated sandstone. The trail climbs to an overlook of the Green River then drops into a twisty valley of hoodoos striped red, cream, and gold.

The trail was named after the Athena Rocket—this stretch of ruddy desert was the Green River Test Site, an outpost of the White Sands Missile Range. From 1964 to 1975, the U.S. Air Force and Army launched 244 missile tests here. The site was abandoned after the test, reclaimed by the Army in the early 2000s, and turned into trails in 2018 as part of the city's plan to attract tourists.

Sure, it's not the uber-aesthetic red rock of Moab. But Moab is overrun with tourism, and it's causing soil erosion and damage to historic sites. Athena, on the other hand, provides uncrowded trail access and a reason for visitors to come to a town that's been riding the economic roller coaster of extraction. It's an example of how to take an unloved and torn-up landscape, scrub the detritus of past environmental exploitation, and turn it into land that's useful to the public.

It's happened successfully in other places, too, where contaminants have been cleaned up, cleared out, or capped. Redhead Mountain Bike Park in Chisholm, Minnesota, used to be iron mine pits. The Hanford Reach National Monument, in eastern Washington, is a wildlife refuge on a corner of the country's biggest nuclear clean-up, where hikers can visit the buffer zone away from the test site.

Reclaiming damaged landscapes for recreation takes pressure off of other precious places. And it creates more spaces to be outside, especially in areas where people haven't previously had access to trails or parks. It's not easy—it takes funding, will, consensus, and a plan to convert a mine or a missile range into a mountain bike trail. But right now several pieces of policy are in play that could shape how we re-envision and restore these landscapes.

In March, Representative Matt Cartwright, from Pennsylvania's eighth district, introduced the RECLAIM Act, and a bill to amend the Surface Mining Control and Reclamation Act of 1977, both of which would

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designate money to states and tribes for cleaning up and repurposing land and water destroyed by mining. It's a pitch to contribute toward the estimated \$280 billion it would take to clean up all the abandoned mines in the U.S., and it's gained traction in the Senate, too. One of the major goals of the RECLAIM Act is to "revitalize coal communities," and build projects that can bring other sources of income to these areas.

The bills dovetail with a bigger conversation about conserving and smartly using lands for the future. On May 6, President Biden announced his ten-year America the Beautiful plan, the beginning of his vision to conserve 30 percent of U.S. lands and waters by 2030 (a goal proponents are calling "30x30" for short). This would mean not just protecting wilderness areas and national parks, but private land, farms of all sizes, and urban green spaces, using public-private partnerships and conservation easements.

Skeptics of Biden's plan say it's broad-stroked and sketchy, and that it has to do more to counter the historically racist practices of conservation and preservation. They say it has to be both realistic and bold. I agree. And that's one of the places where reclamation can come in.

The question of what should "count" as conservation came up regularly in the plan's early listening sessions, according to the report. It's a crucial point, because the focus of 30x30 conservation can't just be to allocate more precious and pristine wilderness. It must also include restoration and reuse of previously damaged landscapes, create access in disadvantaged communities, and uphold treaty rights with tribes. Nature will not heal on its own.

Fortunately, restoration is one of the main tenets of the plan, and recreation is a part of that. The broad goals include more parks and outdoor opportunities in nature-deprived areas (40 percent of the overall benefits from what's vaguely referred to as "relevant federal investments" will go to disadvantaged communities), and the implicit understanding is that the conservation projects will increase access for outdoor recreation. The report also notes that, "Outdoor recreation contributes an estimated \$460 billion to the nation's economy, with mayors and local leaders recognizing parks, beaches, and open spaces as indispensable infrastructure for livable and prosperous communities, for purifying air and drinking water, and in defending against the impacts of climate change."

Recreation is not a panacea. We do harm. We cut up landscapes with footprints, tire tracks, and trash. We shit where we shouldn't. Trail building isn't going to stop climate change. But as the report noted, "Improved access to public lands and waters—in an equitable, well-managed and

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sustainable manner—can broaden and deepen connections to nature and its benefits, and encourage the next generation of outdoor stewards.”

Historically, we’ve designated the most beautiful places for recreation and reflection, but now, if we want to hit ambitious conservation targets like the 30x30 plan, we have to expand the idea of protection and use. We’ve already wrecked and altered so many landscapes and then left them drilled or bombed or leaching waste. By reclaiming lands like the Athena Site, and by turning them into useful recreation areas, we can address a handful of the most pressing land use issues at the same time.

I want beauty and solitude and places to move my body outside, but I also want to know that I’m not causing unnecessary harm. By reclaiming damaged places we can get all of those things and more.

outsideonline.com, 29 May 2021

<https://www.outsideonline.com>

### Aboriginal memory techniques may work better than Sherlock’s ‘memory palace’

2021-05-30

An ancient memory technique developed by Aboriginal Australians may work better than the “mind palace” invented in ancient Greece and popularized by the BBC version of Sherlock Holmes.

Both methods involve mentally attaching information to a physical object or location, but the Aboriginal technique adds a storytelling component. Researchers aren’t sure if it’s the narrative element or some other aspect that seemed to boost the Aboriginal technique’s effectiveness, and the study is small. But the research highlights that cultures put in a lot of effort in order to pass along information without modern-day technology or even writing.

“There’s a certain satisfaction in knowing how to learn these things,” said study co-author David Reser, a lecturer at the Monash University School of Rural Health in Australia.

Building memories

The “mind palace” is a method of remembering that attaches information to objects inside an imaginary building or room; also known as the method of loci, the technique is said to have originated when the Greek poet Simonides of Ceos narrowly avoided being crushed in a building

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collapse during a crowded banquet. Simonides was able to identify the bodies of his fellow revelers by remembering where they’d been sitting before he stepped out of the room, illustrating the value of attaching memories to a physical location — even if just in the mind. The character of Holmes uses the technique to help him crack cases in the BBC series “Sherlock,” which aired between 2010 and 2017. Research on the mind palace technique shows that it boosts both short- and long-term memory.

A new study tests the mind palace technique against the one used by untold generations of Aborigines. This technique also attaches information to physical geography, but in the form of a narrative that incorporates landmarks, flora and fauna. The idea to compare the two arose when Reser and a fellow lecturer, Tyson Yunkaporta, were chatting about memory and ways to incorporate Indigenous culture into the medical school curriculum. Yunkaporta, now at Deakin University in Victoria, Australia, is a member of the Apalech Clan and author of “Sand Talk: How Indigenous Thinking Can Save the World” (HarperOne, 2020).

Along with other colleagues and medical students, Yunkaporta and Reser put together a study of the two techniques, drawing from first-year medical students at the university during their very first days of classes. Seventy-six students participated. They were first shown a list of 20 common butterfly names — chosen specifically because the researchers wanted the study to have nothing to do with medicine — and given 10 minutes to memorize the list. They were then told to write down as many of the names as they could remember.

Next came a 30-minute session during which a third of the students were taught the “memory palace” technique, and a third were taken to a garden on campus, where Yunkaporta walked them through the Aboriginal technique and developed a story attached to the garden for memorizing the butterfly list. The final third, a control group, watched an unrelated video during this time.

The students were again given the list and 10 minutes to memorize; then they were asked to write down the butterfly names again. After a 20-minute unstructured break, they were tested for a third and final time. **PLAY SOUND**

Incorporating a narrative

All of the students improved over the tests, simply because they had seen the list several times. The memory palace technique improved the total percentage of the 20 names that the students remembered by a moderate

**Both methods involve mentally attaching information to a physical object or location, but the Aboriginal technique adds a storytelling component.**

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amount, with the Aboriginal technique showing a strong effect. This translated to only one or two extra names, though, as the test turned out to be a little too easy for the eager medical students — many remembered 20 out of 20 butterfly names on the first try, without any training at all, Reser said. A future study with medical school students would need to be more challenging, he said.

“By the time someone gets into medical school they probably have developed some pretty sophisticated techniques themselves,” he said.

However, other ways of looking at the memory training also showed improvements with the Aboriginal technique compared to the mind palace. The chances that a student would improve from remembering fewer than 20 of the names to 20 out of 20 on later tests tripled in the Aboriginal group, doubled in the mind palace group, and went up only by 50% in the untrained group. The students trained in the Aboriginal technique were also significantly more likely to list the butterfly names in order than the other two groups. The test didn't require ordering the list, Reser said, but it makes sense that students who were attaching the information to a narrative would remember the information in a certain sequence.

“You can envision, certainly, in the medical field things where order is important,” Reser said. “If you're remembering, say, a biochemical pathway or a surgical technique.”

The advantage of the Aboriginal technique may have been due to the additional layer of the narrative, Reser said. Or it could have had something to do with the fact that participants physically went to the garden to learn (the mind palace participants simply imagined their childhood homes). The storytelling of the Aboriginal technique was also communal instead of individual, which could have also helped boost memory.

Not enough students returned for a follow-up for the researchers to test the long-term impacts of the different training methods. Study co-author Magaret Simmons, a senior lecturer at the medical school, did gather feedback from the students after the study and found that they enjoyed learning the techniques and that some still used them in their studies.

That was promising, Reser said, as many medical students feel anxious about the amount of memorization they're expected to do. He and his colleagues would like to incorporate these methods into the curriculum, he said, but it's important that they find an Aboriginal instructor who can

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accurately and sensitively convey the technique. In Aboriginal practice, the method is quite complex, Reser said, with multiple layers of information conveyed through song, stories and art. It also takes hard work and practice to keep the information attached to the narratives fresh.

“We want students to have exposure to Aboriginal culture and to be aware of just how rich and how deep into history this goes,” he said.

The findings were published May 18 in the journal PLOS One.

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[livescience.com](https://www.livescience.com), 30 May 2021

<https://www.livescience.com>



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