

# Bulletin Board

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

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### ASIA PACIFIC

#### National Work Safe month—Work Health and Safety through COVID-19

2020-10-01

To help you prepare, new work health and safety (WHS) resources have been published on the **National Safe Work Month website**, including:

- **Join National Safe Work Month and commit to keeping people safe and healthy at work information sheet**
- **WHS best practice checklist for employers**
- **Keeping WHS a priority in your workplace information sheet**
- **COVID-19 WHS case studies.**

Employers, small businesses, duty holders and work health and safety representatives are encouraged to download these resources and distribute them within their workplaces to keep WHS a priority during National Safe Work Month.

Supporting the overarching National Safe Work Month theme – **Work Health and Safety through COVID-19**, each week of October will focus on a WHS topic, including mental health and using data to create better WHS policy. Each topic has a **downloadable poster and social media tile** so you can easily promote them in your workplace and to your networks.

Don't forget to use **#safeworkmonth** and **#safetytogether**, when promoting your organisation's National Safe Work Month initiatives on social media.

To receive the latest updates, **subscribe** to our National Safe Work Month mailing list.

**Together, we can create safer workplaces for everyone.**

Safe Work Australia, 1 October 2020

<https://www.safeworkaustralia.gov.au/national-safe-work-month/whs-resources>

#### India takes first step towards regulating PFASs

2020-09-20

India has taken its first steps towards developing a framework for regulating and governing per- and polyfluoroalkyl substances (PFASs) by

**Don't forget to use #safeworkmonth and #safetytogether, when promoting your organisation's National Safe Work Month initiatives on social media.**



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adopting international standards for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA).

As a starting point, the Bureau of Indian Standards (BIS) announced on 28 September that it would adopt the following PFOS and PFOA International Standards Organisation (ISO) benchmarks as Indian Standards (IS):

- ISO 3696:1987 water for analytical laboratory use – specification and test methods;
- ISO 5667-1 water quality – sampling – part 1: guidance on the design of sampling programmes and sampling techniques; and
- ISO 8466-1:1990 water quality – calibration and evaluation of analytical methods and estimation of performance characteristics – part 1: statistical evaluation of the linear calibration function.

The consultation process for the adoption of these standards – which involved the Ministry of Consumer Affairs, Food and Distribution, the administrative body for the BIS – has finished and formal notification giving effect to the new standards is expected within the next two months. According to the announcement from the BIS, it **was** “necessary to develop Indian Standards for [the] determination of PFOS and PFOA so that they can be utilised by regulatory bodies in the country”.

### Full Article

Chemical Watch, 30 September 2020

<https://chemicalwatch.com/160646/india-takes-first-step-towards-regulating-pfass>

## AMERICA

### **Notice of modification to the list of Permitted Emulsifying, Gelling, Stabilizing or Thickening Agents to enable the use of citric acid esters of mono- and diglycerides (CITREM) as an emulsifier in whole protein-based infant formulas for special dietary purposes**

2020-09-18

Reference Number: NOM/ADM-0153 [2020-09-18]

Background

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Health Canada’s Food Directorate completed a premarket safety assessment of a food additive submission seeking approval for the use of citric acid esters of mono- and diglycerides (CITREM) in whole protein-based infant formulas for special dietary purposes.

CITREM is already permitted for use as an emulsifying agent in infant formula based on crystalline amino acids or protein hydrolysates, or both.

The results of the premarket assessment support the safety of CITREM for its requested use. Consequently, Health Canada has enabled the use of CITREM described in the information document below by modifying the *List of Permitted Emulsifying, Gelling, Stabilizing or Thickening Agents*, effective **September 18, 2020**.

The purpose of this communication is to publically announce the Department’s decision in this regard and to provide the appropriate contact information for any inquiries or for those wishing to submit any new scientific information relevant to the safety of this food additive.

### Full Article

Government of Canada, 18 September 2020

<https://www.canada.ca/en/health-canada/services/food-nutrition/public-involvement-partnerships/modification-list-permitted-emulsifying-agents-citric-esters-infant-formulas.html>

### **Environmental Protection Agency awards grant to UC Berkeley program for pollution prevention**

2020-09-30

UC Berkeley’s Greener Solutions program was awarded funding from the Environmental Protection Agency on Sept. 23 to research alternatives to potentially dangerous chemicals used in the carpet and food packaging industries.

The \$194,832 grant is one of 42 distributed across the United States by the EPA, which gave out a total of \$9.3 million in funding to combat pollution on the 30th anniversary of the Pollution Prevention Act. The Greener Solutions program will use the funding to investigate alternatives to per- and polyfluoroalkyl substances, or PFAS, which are synthetic chemicals found in consumer and commercial products that are known to have adverse health effects, according to a UC Berkeley College of Chemistry press release.

**“This is a team effort to reduce pollution. It’s not us or them: We’re all working together.”**



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“(The grant) enlists a network of interested parties both at the university, its students and in the regulated business community,” said John Busterud, EPA regional administrator for Region 9. “This is a team effort to reduce pollution. It’s not us or them: We’re all working together.”

According to Tom McKeag, executive director of the Berkeley Center for Green Chemistry, the Greener Solutions program is a 17-week course at the UC Berkeley School of Public Health, in which teams of graduates and upper division undergraduates partner with companies and nonprofit organizations to identify safe, innovative solutions to chemical processes.

In the past eight years, the Greener Solutions program has partnered with more than a dozen organizations, including Nike, Method, Patagonia, Autodesk, Beautycounter and Costco, McKeag added.

“There is a patchwork quilt of regulations; there is no one unifying chemical regulation program,” McKeag said. “Citizens, for instance, think that they’re very well-protected against toxic and harmful chemicals, but that is not always the case.”

Commonly referred to as “forever chemicals,” PFAS products have a chemical structure that prevents them from breaking down, allowing them to build up in soil, water and bodies, according to McKeag.

Busterud explained that PFAS serve as stain repellents and flame retardants in the carpet industry. In food packaging products, PFAS are used as grease repellents, according to John Katz, EPA pollution prevention coordinator for Region 9.

### Full Article

The Daily Californian, 30 September 2020

<https://www.dailycal.org/2020/09/30/environmental-protection-agency-awards-grant-to-uc-berkeley-program-for-pollution-prevention/>

### **Colorado enacts arsenal of laws to stop ‘forever chemicals’**

2020-09-30

Colorado joined 12 other states this month, launching an array of new laws and monitoring regulations in an effort to stop water contamination caused by PFAS, the so-called “Forever Chemicals.”

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In a major push to protect the public, a new regulation requiring Colorado manufacturers, wastewater treatment plants and others to monitor PFAS, the so-called “forever chemicals,” took effect in September.

It is one of several new laws and regulations the state has enacted in the past four months related to PFAS. In taking these actions, Colorado becomes one of 12 states that have opted to move out ahead of the U.S. Environmental Protection Agency, establishing their own regulations, monitoring sources of the chemicals, and setting limits on how much of the various contaminants can exist in water supplies before they pose a threat to public health.

Found in such common substances as Teflon, Scotchguard and firefighting foam, there are thousands of PFAS, or per- and poly-fluoroalkyls, in use today. They’ve been linked to cancer, kidney disease and other serious illnesses and are considered particularly dangerous because they build up in human tissue.

### **Military sources**

Colorado is home to several military bases where the use of PFAS firefighting foam has resulted in groundwater contamination. Security, Fountain and Widefield in El Paso County have seen widespread contamination, a fact that has local activists applauding the state for taking action to monitor the chemicals and stop them from entering Colorado’s water.

“We did it!” said Liz Rosenbaum, one of the founders and organizers of the Fountain Valley Clean Water Coalition, a local group which has advocated for such a policy for four years. “The most important thing was hearing the Water Quality Control Commission [the state entity that sets water quality rules] validate that the concerns of the people are more important than industry,” said Rosenbaum.

### Full Article

Journal Advocate, 30 September 2020

<https://www.journal-advocate.com/2020/09/30/colorado-enacts-arsenal-of-laws-to-stop-forever-chemicals/>

**But the EPA has taken no public action to start regulating or evaluating the chemicals.**



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### EPA lets two toxic chemicals fall into regulatory 'black hole'

2020-10-01

The EPA has failed to regulate or review two fragrance ingredients considered to be among the most hazardous chemicals in production—and among those Congress directed the agency to address faster than any others.

The Environmental Protection Agency's lack of action over the past four years, since Congress overhauled the Toxic Substances Control Act, has drawn the ire of outside observers and even a senator who led that overhaul effort. Sen. Tom Udall (D-N.M.) said the delay runs "afoul of the spirit and plain reading of the law."

The 2016 TSCA amendments required the EPA to fast-track the process to regulate a set of high-hazard chemicals known as PBTs, because they persist in the environment, bioaccumulate—or build up in the food chain—and are toxic.

The fragrance ingredients were among those red-flagged. The more widely produced of the two—described by manufacturers as having a woody scent—is present in air fresheners, laundry detergent, fabric softeners, and personal care products, according to an EPA database.

A chemical manufacturer in 2016 requested performing a risk evaluation of the ingredients. But the EPA has taken no public action to start regulating or evaluating the chemicals.

#### EPA Says Action in 'Near Future'

The inexplicable delay "is bizarre," said Steve Owens, an attorney who served as EPA's assistant administrator for chemical safety and pollution prevention during the Obama administration.

"What's really baffling is the agency's lack of transparency," said Owens, now a partner in the Phoenix and Washington, D.C. offices of Squire Patton Boggs LLP. Overall, "the TSCA program has done a very good job in terms of being transparent about what it's doing."

"This really stands out as an aberration from that," Owens said. "It's really a black hole."

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EPA spokeswoman Molly Block said the agency is working with a group of chemical manufacturers to develop a complete risk evaluation request, and expects to receive it "in the near future."

TSCA doesn't contain a deadline for the EPA to act. But the agency may have violated the Administrative Procedure Act by not following Congress' order to act quickly, said Eve Gartner, an attorney for the nonprofit environmental law group Earthjustice.

"EPA's many-year delay is leaving consumers exposed to chemicals that Congress considered the worst of the worst," she said.

#### Limited Off-Ramps

Congress created a special section of TSCA, 6(h), creating the speedy regulatory process for certain PBTs and allowing only two off-ramps.

One is if the EPA found that people and wildlife had such limited exposure to a high-hazard chemical that it didn't need to be regulated. The other is if a manufacturer disagreed with a chemical's high-hazard designation and offered to pay the EPA to evaluate the chemical's risks.

Of the seven chemicals the EPA deemed as high-risk in 2016, four of them needed regulating while one lacked the exposure needed for regulation, the agency concluded. Final regulations controlling these other chemicals are on track to be released by the end of this year, Alexandra Dapolito Dunn, EPA's assistant administrator for chemical safety and pollution prevention, recently told Bloomberg Law.

International Flavors & Fragrances Inc., a fragrance manufacturer, disputed the high-hazard label for the remaining two chemicals and offered to pay for the risk evaluation in 2016. The company declined to comment when reached by Bloomberg Law.

#### Full Article

Bloomberg Law, 1 October 2020

<https://news.bloomberglaw.com/environment-and-energy/epa-lets-two-toxic-chemicals-fall-into-regulatory-black-hole>

**PFAS are a group of man-made chemicals that are manufactured and used in a variety of industries around the world (e.g. textiles, household products, fire-fighting, automotive, food processing, construction, electronics).**



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### EUROPE

#### PFAS in food: EFSA assesses risks and sets tolerable intake

2020-09-17

EFSA has set a new safety threshold for the main perfluoroalkyl substances, or PFAS, that accumulate in the body. The threshold – a group tolerable weekly intake (TWI) of 4.4 nanograms per kilogram of body weight per week – is part of a scientific opinion on the risks to human health arising from the presence of these substances in food.

PFAS are a group of man-made chemicals that are manufactured and used in a variety of industries around the world (e.g. textiles, household products, fire-fighting, automotive, food processing, construction, electronics).

Exposure to these chemicals may lead to adverse health effects. People can be exposed to PFAS in different ways, including food, where these substances are most often found in drinking water, fish, fruit, eggs, and egg products.

The four PFAS that EFSA's assessment focused on are perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorononanoic acid (PFNA), perfluorohexane sulfonic acid (PFHxS).

Toddlers and other children are the most exposed population groups, say EFSA scientists, and exposure during pregnancy and breastfeeding is the main contributor to PFAS levels in infants.

Experts considered the decreased response of the immune system to vaccination to be the most critical human health effect when determining the TWI. This differs from EFSA's previous opinion on PFAS from 2018, which used increased cholesterol as the main critical effect.

The 2018 opinion set separate TWIs for PFOS and PFOA, but EFSA has re-evaluated these substances considering more recent scientific knowledge and has followed its recent guidance for assessing combined exposure to multiple chemicals.

The latest scientific opinion addresses the feedback received from scientific organisations, citizens, and competent authorities in Member States during a two-month consultation between February 2020 and April 2020.

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EFSA's scientific advice will support risk managers in their decisions on how best to protect consumers from exposure to PFAS through food.

How can food become contaminated with PFAS?

Food can become contaminated through contaminated soil and water used to grow the food, through the concentration of these substances in animals via feed and water, through food packaging containing PFAS, or processing equipment that contains PFAS.

- [Scientific opinion: Risk to human health related to the presence of perfluoroalkyl substances in food](#)
- Technical report: Outcome of a public consultation on the draft risk assessment of perfluoroalkyl substances in food

[Full Article](#)

EFSA, 17 September 2020

<http://www.efsa.europa.eu/en/news/pfas-food-efsa-assesses-risks-and-sets-tolerable-intake>

#### UK's medicine and medical devices regulator to tackle Brexit, technological advancements and regulatory challenges (including from COVID-19) in 2020 and 2021

2020-09-30

The MHRA has established five strategic goals for 2020-21 that will impact all those operating in the UK medicines and medical devices industries

The UK's Medicines and Healthcare products Regulatory Agency ('MHRA') is undergoing a fundamental change of its structure, culture and working practises in order to ensure the UK can continue to access innovative medicines, medical devices and other products during the COVID-19 pandemic and in the post-Brexit world. Its future strategy is outlined in its 2020-21 business plan which is designed to counteract what it has identified as the biggest potential challenges for industry in the near future: the UK's exit from the EU; technological and scientific advances and new regulatory challenges (e.g. digitally based products/AI and product development, production processes and novel supply chains). Its overall aim is to implement new overarching long-term ideals: focus on UK patients' access to highly innovative products whilst still prioritising patient safety; transform post-market surveillance into a systematic data driven analysis of real-world data (or 'RWD') and use Artificial Intelligence

**To achieve its ends, the MHRA has established five key specific, strategic goals for 2020-21.**



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('AI') and measure impact according to patient engagement, influence and ability to make informed choices.

To achieve its ends, the MHRA has established five key specific, strategic goals for 2020-21.

1. **Ensure patients, public and the health service can access effectively and acceptably safe medical products** by enhancing its public messaging (including online), implement a 'patient first' culture and improve the exchange of information between the MHRA and public.
- **Embed innovation and develop regulatory science to ensure patients access the most advanced healthcare products by** improving regulatory science (launch the Clinical Practice Research Datalink (CPRD) to hold de-identified patient data from GP practices across the EU, enhance its scientific regulatory with a new science strategy (by Q3 of 2020-21) and innovative biological standard (by Q4 of 2020-21) and improve market entry mechanisms (including in biosimilar products). This theme is the same as that emphasised in respect of chemical regulation in the EU, as part of ECHA in its strategic plan, as we have previously outlined),
- **Orient lifecycle and safety management based on data and information to improve proportionate decision-making in the interests of patients and published guidance** by developing a risk-based approach to manage product safety, form strategic partnerships with healthcare professionals and determine success of MHRA's operations by implementation of the Yellow Card (the voluntary reporting of suspected adverse side effects) biobank (By end of Q4 of 2020-21)
- **Have data and evidence based analytics underpin the regulatory and science processes in order improve patient safety and health outcomes** by improving analytics and automation of regulatory decision-making.
- **Establish strong leadership, improve governance and operate strategically with across the health and care sector** by enhancing management structure and assessment of deliverables .

[Full Article](#)

Lexology, 30 September 2020

<https://www.lexology.com/library/detail.aspx?g=7aeb0cef-055e-4233-8b12-e51a00cf7c07>

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## INTERNATIONAL

**OECD reports on PFAS alternatives for food packaging**

2020-09-28

Report by Organisation for Economic Co-operation and Development (OECD) investigates market availability and use of alternatives to per- and polyfluoroalkyl substances (PFAS) in paper and board coatings; finds non-fluorinated alternatives available and effective, market uptake primarily limited by increase in price.

In September 2020, the *Organisation for Economic Co-operation and Development (OECD)* published a report investigating the commercial availability and current uses of per- and polyfluoroalkyl substances (PFAS) and non-fluorinated alternatives in food packaging. Developed with the support of government, industry, academic, and civil society stakeholder members of the organization's Global Perfluorinated Chemicals (PFC) Group, it provides information on the availability of the substances for use in food packaging, market trends, and policy recommendations.

The report finds that both short-chain (SC) PFAS and non-fluorinated alternatives "are available on the global market and can be used to produce paper and board for use in food packaging." Based on information from US government sources, it identifies 28 fluorinated substances used across 19 formulations to create paper and board food packaging. Information from German authorities found 12 fluorinated substances designated for use in surface or coating agents.

Overall, both short-chain PFAS and non-fluorinated alternatives are shown to "meet the high grease and water repellence specifications required for the common food and pet food packaging uses." In the report, it is also stated that "for some applications, non-fluorinated alternatives have a performance advantage over SC PFAS." An analysis of the current market revealed that non-fluorinated alternatives make up about 1% or less of the market share, and it attributes this limited use to the higher cost of non-fluorinated alternatives. Food packaging made from non-fluorinated alternatives were found to be 11 to 32% more expensive than packaging made with SC PFAS.

While the *OECD* identified that some technical challenges exist in transitioning from fluorinated to non-fluorinated alternatives, it concludes that "the main obstacle to substitution" is the increased cost. However, "if there are sufficiently strong reasons for the value chain to pay for the

**The report finds that both short-chain (SC) PFAS and non-fluorinated alternatives "are available on the global market and can be used to produce paper and board for use in food packaging."**



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premium non-fluorinated alternatives, it will do so.” With an increase in retailer initiatives to switch to non-fluorinated alternatives (FPF reported), as well as a growing number of regulatory restrictions on PFAS in food packaging such as those in Denmark (FPF reported) and the US states of Washington (FPF reported) and New York (FPF reported), there soon may be reason enough for the value chain to switch to non-fluorinated alternatives.

In a set of concluding recommendations, the report encourages governments to “further disseminate information on the potential health and environmental risks of PFAS and non-PFAS alternatives” and to “consider funding research into non-PFAS alternatives, including an understanding of their functionality, costs and potential health and environmental risks.” To industry stakeholders, it recommends to “evaluate options to increase the transparency of the food packaging industry and its use of PFAS/non-PFAS alternatives.” This includes “making scientifically robust information available publicly on intentionally used PFAS and non-fluorinated alternatives in food packaging.”

### Reference

OECD (September 2020). “PFASs and alternatives in food packaging (paper and paperboard): Report on the commercial availability and current uses.” ([pdf](#))

### Full Article

Food Packaging Forum, 28 September 2020

<https://www.foodpackagingforum.org/news/oecd-report-on-pfas-alternatives-for-food-packaging>

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## REACH Update

OCT. 09, 2020

### Tattoos may not be going out of fashion—but toxic inks are about to

2020-09-27

There’s no denying that tattoos are becoming more and more common in society today. In fact, one in four Europeans between the ages 18 to 35 have a tattoo. While the health risks of using dirty needles have been known for some time, the inks that are being injected under the skin have until recently not raised a lot of concern among consumers.

But the truth is that tattoo inks are made up of a complex mix of chemicals that stay in the body for life, and several of these chemicals are known or suspected to cause cancer, genetic mutations, toxic effects on reproduction, allergies or other negative health effects.

Pigments are the main ingredients in tattoo inks. These pigments are, however, not produced specifically for tattoos. In fact – as crazy as it may sound – the pigments used in tattoo inks are usually produced by the chemical industry for products like textiles, car paints and plastics.

For this reason, no risk assessment that considers the pigments’ injection and permanence in the human body is carried out – which adds to the concern. Especially when the most commonly used pigments in tattoo inks are proven to release potentially carcinogenic aromatic amines when exposed to intense light such as the sun or laser (often used for tattoo removal).

Moreover, tattoo pigments may contain up to 30% impurities where many harmful chemicals have been found – such as cancer-causing chromium VI and cobalt.

In light of this, EU member states recently voted in favour of an EU-wide legislation that would restrict the use of hazardous chemicals in tattoo inks and permanent make-up. The restriction would impose concentration limits for dozens of harmful chemicals.

Some of these substances are already restricted under an EU cosmetics law and not allowed to be used on the skin. It makes sense, therefore, that it wouldn’t be safe to inject them under the skin either.

This proposal has been cooking for some years. Already in 2017, the European Chemicals Agency (ECHA) together with a couple of member states submitted a proposal to restrict certain chemicals in tattoo inks and permanent make-up, stating human health risks as a primary concern.

**For this reason, no risk assessment that considers the pigments’ injection and permanence in the human body is carried out – which adds to the concern.**



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Now, three years later, an EU restriction may soon enter into force.

Two specific pigments – blue 15:3 and green 7 – have however been exempted from the restriction, following a call from industry. Industry argued that an exemption would give small tattoo shops “a fair chance to prosper” since the pigments are needed to cover the entire colour spectrum and available alternatives are unsuitable.

This means that – for these two pigments – industry is given two years to find safer alternatives and remove them from the market. For all other chemicals, the restriction would apply one year after the regulation enters into force.

“We’ve been waiting for this restriction to be finalised. Hazardous chemicals should have been phased out of tattoo inks a long time ago. We do not, however, agree with the decision to let two pigments off the hook simply because small tattoo studios aren’t ready to switch to safer alternatives yet”, says Frida Hök, Deputy Director at ChemSec.

The restriction proposal will now be scrutinised by the European Parliament and the Council of Ministers before it can be adopted by the EU Commission.

Chemsec, 27 August 2020

<https://chemsec.org/tattoos-may-not-be-going-out-of-fashion-but-toxic-inks-are-about-to>

### OTE wins ECHA contract for Microsoft systems consultancy services

2020-10-01

OTE said it has undertaken a project for the European Chemicals Agency (ECHA) in Helsinki following an open tender. Over the next four years, it will provide consulting services and management, implementation and support of applications and systems based on Microsoft technologies. Implementation and monitoring will be done by specialist engineers from OTE and its associates, mainly from Athens but also with a physical presence at the ECHA facilities in Helsinki.

OTE will provide consulting services to the EU organisation for existing and new Microsoft technology systems installed either on ECHA infrastructure or in the cloud, in the areas of business architecture, security and ICT systems strategy, application development and automated application management (DevOps) and Service Desk.

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This is the third project awarded to OTE by the ECHA in a few months. OTE Group has already undertaken the management of applications of ECHA websites and the supply, installation, management and technical support of the IT equipment at its central offices, on an as-a-service basis.

Telecompaper.com, 1 October 2020

<https://www.telecompaper.com/news/ote-wins-echa-contract-for-microsoft-systems-consultancy-services--1356165>

### Echa’s Rac ponders waste route for diagnostic tests containing SVHCs

2020-10-02

A flurry of REACH authorisation applications for an environmental endocrine disrupting chemical called Triton X-100 is highlighting a potential disposal issue for hospitals and labs using test kits containing the substance. Echa’s Risk Assessment Committee (Rac) is concerned the surfactant could enter water systems via sewage and landfill, and has discussed risk management measures targeting waste.

The committee is working its way through tens of REACH authorisation applications for octyl and nonylphenol ethoxylates (OPnEOs and NPnEOs), which are substances of very high concern (SVHCs) based on endocrine-disrupting properties in the environment. OPnEOs and NPnEOs degrade during sewage treatment and in the environment to form the more toxic SVHCs, nonylphenol and octylphenol.

[Full Article](#)

Chemical Watch, 2 October 2020

<https://chemicalwatch.com/161589/echas-rac-ponders-waste-route-for-diagnostic-tests-containing-svhcs>

**Echa’s Risk Assessment Committee (Rac) is concerned the surfactant could enter water systems via sewage and landfill, and has discussed risk management measures targeting waste.**



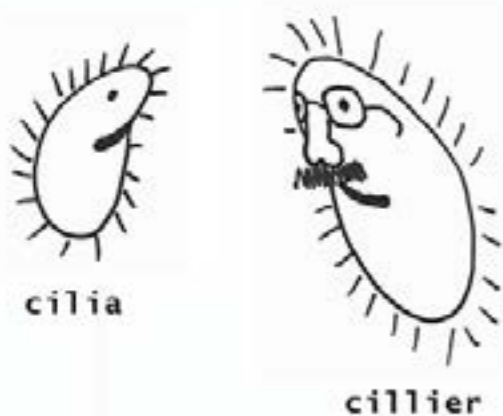
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## Janet's Corner

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## Silly

2020-10-09



<https://www.pinterest.com.au/pin/275423333434392957/>

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## Hazard Alert

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## Ammonium chloride

2020-10-09

Ammonium chloride is an inorganic white crystalline chloride. It is soluble in water. Its chemical formula is  $\text{NH}_4\text{Cl}$ . It is a product from the reaction between hydrochloric acid and ammonia. [1,2,3]

## USES [2,4]

Ammonium chloride is used across a range of applications in various industries. It is used as an ingredient in fertilisers, as an electrolyte in dry cells and in tinning. The chemical is used to clean soldering irons, in tanning and in washing powders and in the manufacture of dyes. It is also used in cold and cough medicines, and in veterinary medicine to prevent urinary stones.

## ROUTES OF EXPOSURE [5]

- A person can be exposed to different forms of ammonium chloride by multiple routes of exposure, including skin and eye contact, ingestion and inhalation.

## HEALTH EFFECTS

Ammonium chloride poisoning affects a range of systems, including the integumentary and respiratory systems.

## Acute Effects [4]

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

Inhalation of ammonium chloride fumes can result in irritation of the nose, throat and lungs, including coughing and a sore throat. People with impaired respiratory functions, such as those with emphysema much incur further damage if the chemical is inhaled. Ingestion of the chemical could result in serious negative health consequences, including death. Eye contact with the chemical may cause corneal injury, pain, redness, inflammation and/or significant ocular lesions.

## Chronic Effects [4]

Chronic exposure to ammonium chloride is not thought to cause major adverse health effects. However, as a matter of course, exposure to all routes should be minimised. Long term exposure to high concentrations of the chemical in dust form may result in changes of lung function, e.g.

**Ammonium chloride is an inorganic white crystalline chloride.**



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## Hazard Alert

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pneumoconiosis. This is caused by chemical particles less than 0.5 micron entering and staying in the lung. A major symptom is breathlessness.

### SAFETY

#### First Aid Measures [4]

- Ingestion: If swallowed, contact a medical professional without delay. If the patient is more than 15 minutes away from a hospital, or unless otherwise instructed, induce vomiting ONLY IF THE PATIENT IS CONSCIOUS.
- Skin contact: Remove all contaminated clothing, footwear and accessories. Do not re-wear clothing until it has been thoroughly decontaminated. Immediately rinse affected areas with plenty of soap and water. Contact a doctor in the event of continued irritation.
- Eye contact: Flush eyes (including under the eyelids), with water for at least 15 minutes. Removal of contact lenses should only be done by skilled personnel. Contact a medical professional immediately.
- Inhalation: If the person inhales fumes, combustion products or aerosols, remove them from the contaminated site. Other measures are usually unnecessary. If in doubt, contact the poisons information centre.
- General: Never administer anything by mouth to an unconscious, exposed person.

#### Exposure Controls/Personal Protection [4]

- Engineering controls: Emergency eyewash fountains and quick-drench areas should be accessible in the immediate area of the potential exposure. Ensure there is adequate ventilation. Use a local exhaust ventilation or process enclosure, to limit the amount of chemical dust in the air.
- Personal protection: Safety glasses, protective and dustproof clothing, gloves (protection class 5 or higher), a P.V.C apron and an appropriate mask or dust respirator. Do not wear contact lenses as they could absorb chemicals in the air. Wear impervious shoes. Other protection could include barrier cream and skin cleansing cream. For specifications regarding other PPE, follow the guidelines set in your jurisdiction.

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### REGULATION [5]

#### United States:

The National Institute for Occupational Safety and Health (NIOSH) has set a Time Weighted Average (TWA) concentration limit for ammonium chloride (fume) of 10mg/m<sup>3</sup>.

#### Australia [4]

Australia Exposure Standards have set a TWA for ammonium chloride of 10mg/m<sup>3</sup>.

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**Police confiscate 345,000 recycled condoms in Vietnam**

2020-09-25

Police in Vietnam have confiscated an estimated 345,000 used condoms which had been cleaned and resold as new, state media reported.

Footage by state-owned Vietnam Television (VTV) this week showed dozens of large bags containing the used contraceptives scattered across the floor of a warehouse in the southern province of Binh Duong.

Police said the bags weighed over 360kg (794 lbs), equivalent to around 345,000 condoms, according to VTV.

The owner of the warehouse said they had received a “monthly input of used condoms from an unknown person”.

A woman detained during the operation told police the used condoms were first boiled in water then dried and reshaped on a wooden phallus before being repackaged and resold.

VTV said it was not clear how many of the recycled condoms had already been sold. The detained woman said she had received \$0.17 (£0.13) for every kilogram of recycled condoms she produced.

Neither she nor the owner of the warehouse were available for comment.

theguardian.com, 25 September 2020

<https://www.theguardian.com>

**A beaked whale’s nearly four-hour-long dive sets a new record**

2020-09-23

To break the record for longest dive by a marine mammal, take a deep breath and jump in the water. Then don’t breathe in again for almost four hours.

Cuvier’s beaked whales (*Ziphius cavirostris*) are master divers (SN: 08/21/18). The creatures not only hold the record for deepest plunge by a marine mammal — measuring nearly 3,000 meters — but also for the longest dives. In 2014, scientists documented one dive that lasted just over two hours at 137.5 minutes, setting a record. Another Cuvier’s beaked whale has now shattered that record, going 222 minutes, or three hours and 42 minutes, without coming up for air, researchers report September 23 in the *Journal of Experimental Biology*.

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To last so long underwater, the mammals may rely on large stores of oxygen and a slow metabolism. Once oxygen runs out, the animals may have the ability to tolerate lactic acid building up in their muscles from anaerobic respiration — a method of generating energy that doesn’t rely on oxygen. “These guys blow our expectations,” says Nicola Quick, an animal behaviorist at Duke University Marine Laboratory in Beaufort, N.C.

Calculations based on a seal’s oxygen stores and diving time limits hinted that the whales should last only about half an hour before running out of oxygen. Seals can exceed their limit about 5 percent of the time, so Quick’s team analyzed 3,680 dives by 23 whales. While most dives lasted around an hour, 5 percent exceeded about 78 minutes, suggesting it takes more than twice as long as thought for the whales to switch to anaerobic respiration.

The researchers expected to find that the whales spend more time at the surface recovering after long dives, but the team did not see a clear pattern. “We know very little about [the whales] at all,” Quick says, “which is interesting and frustrating at once.”

sciencenews.org, 23 September 2020

<https://www.sciencenews.org>

**This \$1 hearing aid could treat millions with hearing loss**

2020-09-23

As an undergraduate in Mumbai, India, Saad Bhamla wanted to do something nice for his maternal grandparents: Buy them a pair of hearing aids. But the prices were shockingly high—and far beyond his means. Now, 15 years later, the bioengineer has invented a device to help grandparents across the globe: a do-it-yourself hearing aid made from inexpensive, easy-to-find parts. The no-frills device, described in a new study, could help restore hearing to millions suffering from age-related hearing loss—for less than the price of a bottle of water.

The new device is “incredibly compelling,” says Frank Lin, an ear, nose, and throat doctor at the Cochlear Center for Hearing and Public Health at Johns Hopkins University who was not involved in the work.

Globally, 230 million people aged 65 and older experience age-related hearing loss. Typically, high-pitch sounds become harder to distinguish, like electronic beeps and speech sounds such as “s” and “th.” Conversations

**Globally, 230 million people aged 65 and older experience age-related hearing loss.**



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can seem mumbled, and background noise feels distracting and invasive. Such deficiencies can be isolating, Lin says, and his research suggests **they can also accelerate cognitive decline.**

To regain their abilities, many seniors turn to hearing aids. Custom hearing aids amplify sound in the exact frequencies that the listener cannot hear. But at nearly \$5000 a pair, these devices are “practically a luxury item” for many in low- and middle-income countries, says Bhamla, who specializes in “frugal science” at Georgia Institute of Technology. Lower grade hearing aids are cheaper, but they can’t be customized, and they still cost up to \$500. They’re like “cheap earphones in an airplane,” Bhamla says.

Inspired by his grandparents and a hearing-impaired colleague—who is first author on the new paper—Bhamla and his team set out to develop a cheap hearing aid built with off-the-shelf parts. They soldered a microphone onto a small circuit board to capture nearby sound and added an amplifier and a frequency filter to specifically increase the volume of high-pitch sounds above 1000 hertz. Then they added a volume control, an on/off switch, and an audio jack for plugging in standard earphones, as well as a battery holder. The device, dubbed LoCHAid, is the size of a matchbox and can be worn like a necklace. At bulk rates, Bhamla says, it would cost just under \$1 to make. But anyone with the **freely available blueprints** and a soldering iron can make their own for not much more—maybe \$15 or \$20, Bhamla says. The parts are easy to source, he says, and putting them together takes **less than 30 minutes.**

Next, Bhamla and his colleagues tested the device. They found that it **boosted the volume of high-pitch sounds** by 15 decibels while preserving volumes at lower pitches. It also filtered out interference and sudden, loud sounds like dog barks and car horns. Finally, tests with an artificial ear revealed that LoCHAid might improve speech recognition, by bringing conversations closer to the quality heard by healthy individuals. It complied with five out of six of the World Health Organization’s preferred product recommendations for hearing aids, the researchers report today in *PLOS ONE*.

Its simplicity has a few drawbacks, however. The device can’t be fine-tuned for individual needs or adapted to treat other hearing issues. And even though it’s waterproof and shock resistant, the scientists anticipate that LoCHAid’s parts will wear out after about a year and a half. Its bulky size might deter some users, Bhamla says, although a smaller version is in the works.

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But engineering is only half the battle. Until LoCHAid is clinically tested, it cannot be sold as a “hearing aid” in most countries—including the United States. Ultimately, Bhamla wants to get an approval to sell the device over the counter without a prescription, like ibuprofen or reading glasses. “It’s something we’re still figuring out,” he says.

The next step is getting people to use the devices. In low- and middle-income countries, only 3% of people with age-related hearing loss wear hearing aids, and in countries like the United States, the adoption rate hovers at about 20%, according to Bhamla. Aside from concerns about cost, Bhamla says, “a lot of people don’t realize they have hearing loss ... and then there’s the social stigma of wearing the aid.”

But if these cheap, colorful devices take off, they could benefit many people on the brink of cognitive decline, Lin says. “Theoretically, if you treat hearing loss, you might modify those pathways and reduce the risk of dementia.”

Bhamla wants biomedical devices to be as cheap and accessible as consumer electronics. He still remembers the shock of learning that he couldn’t afford to help his grandparents. “I thought owning a laptop and a cellphone meant I had the means to buy hearing aids, but then I realized how expensive they were,” he recalls. “It was sobering.”

sciencemag.org, 23 September 2020

<https://www.sciencemag.org>

### 356 elephants dropped dead. Did this bacteria poison them?

2020-09-23

In May and June, conservationists discovered the carcasses of 356 elephants in Botswana’s Okavango Panhandle. Some of the animals appeared to have collapsed and died suddenly, while walking or running. Others seemed disoriented, walking in circles before they died.

While the elephant deaths have ceased, their cause has remained a mystery, creating fears among some experts about the future of the mighty mammals in a country where their conservation has largely been a success story.

None of the bodies contained bullet holes and no tusks were removed, implying that ivory poachers were not involved. Some experts suspected

**None of the bodies contained bullet holes and no tusks were removed, implying that ivory poachers were not involved.**



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that poisoning by local people might still be to blame, while others thought something in nature was the most likely explanation.

On Monday, Botswanan officials announced their answer: Neurotoxins produced by cyanobacteria, a type of microscopic algae, caused the elephants to die after they drank from large puddles that formed after rains. While some conservationists accepted the explanation, others did not consider the mystery solved and feared that the elephants could again face renewed danger.

Cyril Taolo, deputy director of Botswana's Department of Wildlife and National Parks, announced the government's findings at a [news conference](#).

"There's absolutely no reason to believe that there was human involvement in these mortalities," he said. "This is not a phenomenon that was just seen now, it is something that happens quite a lot when there are these environmental changes."

Mmadi Reuben, the government's principal veterinary officer, added that "there are a lot of questions that still need to be answered," including why elephants were the only species that died and what caused the deadly outbreak.

Some conservationists were also concerned that the government did not disclose the name of the lab that produced the findings, nor did officials reveal how many samples were taken and from where, which tests were performed and which species of cyanobacteria was implicated. Officials did not respond to interview requests.

"There's just so many questions that are outstanding," said Pieter Kat, director of LionAid, a nonprofit conservation organization, and who has worked extensively in Botswana and researched wildlife diseases there. "They need to be completely transparent about the laboratories the samples were sent to and the lab reports."

Most types of cyanobacteria that produce neurotoxins occur in marine environments, where they can cause red tides. A few species are found in freshwater around the world, and they sometimes kill dogs, cattle and other animals that drink from or swim in contaminated water bodies.

"One of the biggest unresolved issues is why there seems not to have been collateral mortality," said Chris Thouless, head of research at Save the Elephants, an organization based in Kenya. "That is one of the reasons we

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originally said this was not a probable explanation, because other animals didn't seem to be dying."

Elephants account for the majority of wildlife in the area, but cattle are also found there, Dr. Thouless said. He has not been able to verify, however, whether cattle drink from the same bodies of water used by elephants.

That said, he added, "While no suggested cause is a perfect fit to observations, this one is less improbable than the others, so I am inclined to accept it, particularly since this is supported by lab results."

There are several possible explanations for why only elephants died, said Roy Bengis, a veterinary wildlife specialist at the University of Pretoria in South Africa, who formerly served as chief state veterinarian at Kruger National Park.

It could be that elephants are "exquisitely sensitive" to whichever particular neurotoxin killed them, whereas other species are more resistant, Dr. Bengis said. "We know this happens — different species of animals have different tolerances."

Elephants also drink copious amounts of water, up to 40 gallons a day, so they would be taking in a larger dose of toxin than a smaller animal. Additionally, unlike most other species, elephants "actually go and frolic in the water and roll in the mud and spray themselves," Dr. Bengis said. The neurotoxin might have been absorbed through their skin.

Why vultures and other scavengers were not impacted is another unanswered question. A neurotoxin would most likely have been concentrated in the elephants' relatively small and inaccessible brains and spinal cords, making it less likely to be consumed, Dr. Bengis said.

But not all conservationists are convinced that toxic algae are responsible. "The chance was lost to find out what has really happened to the elephants, because of the government of Botswana's unwillingness to collaborate with the research community at an early stage," said Keith Lindsay, a conservation biologist at the Amboseli Trust for Elephants in Kenya. "There remain big questions over whether any useful samples were collected."



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Dr. Bengis added that without seeing the lab results or knowing more about the samples, "I can't say yea or nay with regards to whether this diagnosis is correct or incorrect, or possible or impossible."

nytimes.com, 23 September 2020

<https://www.nytimes.com>

### World's richest 1% causes double co2 emissions of the poorest 50%, says Oxfam

2020-09-21

The wealthiest 1% of the world's population were responsible for the emission of more than twice as much carbon dioxide as the poorer half of the world from 1990 to 2015, according to new research.

Carbon dioxide emissions rose by 60% over the 25-year period, but the increase in emissions from the richest 1% was three times greater than the increase in emissions from the poorest half.

The report, compiled by [Oxfam](#) and the Stockholm Environment Institute, warned that rampant overconsumption and the rich world's addiction to high-carbon transport are exhausting the world's "carbon budget".

Such a concentration of carbon emissions in the hands of the rich means that despite taking the world to the brink of climate catastrophe, through burning fossil fuels, we have still failed to improve the lives of billions, said Tim Gore, head of policy, advocacy and research at [Oxfam](#) International.

"The global carbon budget has been squandered to expand the consumption of the already rich, rather than to improve humanity," he told the Guardian. "A finite amount of carbon can be added to the atmosphere if we want to avoid the worst impacts of the climate crisis. We need to ensure that carbon is used for the best."

The richest 10% of the global population, comprising about 630 million people, were responsible for about 52% of global emissions over the 25-year period, the study showed.

Globally, the richest 10% are those with incomes above about \$35,000 (£27,000) a year, and the richest 1% are people earning more than about \$100,000.

Carbon dioxide emissions accumulate in the atmosphere, causing heating, and temperature rises of more than 1.5C above pre-industrial levels would

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cause widespread harm to natural systems. That accumulation gives the world a finite carbon budget of how much carbon dioxide it is safe to produce, which scientists warn will be exhausted within a decade at current rates.

If left unchecked, in the next decade the carbon emissions of the world's richest 10% would be enough to raise levels above the point likely to increase temperatures by 1.5C, even if the whole of the rest of the world cut their emissions to zero immediately, according to Monday's report.

Oxfam argues that continuing to allow the rich world to emit vastly more than those in poverty is unfair. While the world moves towards renewable energy and phases out fossil fuels, any emissions that continue to be necessary during the transition would be better used in trying to improve poor people's access to basic amenities.

"The best possible, morally defensible purpose is for all humanity to live a decent life, but [the carbon budget] has been used up by the already rich, in getting richer," said Gore.

He pointed to transport as one of the key drivers of growth in emissions, with people in rich countries showing an increasing tendency to drive high-emitting cars, such as SUVs, and take more flights. Oxfam wants more taxes on high-carbon luxuries, such as a frequent-flyer levy, to funnel investment into low-carbon alternatives and improving the lot of the poor.

"This isn't about people who have one family holiday a year, but people who are taking long-haul flights every month – it's a fairly small group of people," said Gore.

While the coronavirus crisis caused a temporary dip in emissions, the overall impact on the carbon budget is likely to be negligible, according to Gore, as emissions have rebounded after lockdowns around the world. However, the experience of dealing with the pandemic should make people more aware of the need to try to avert future catastrophe, he said.

Caroline Lucas, the Green party MP, said: "This is a stark illustration of the deep injustice at the heart of the climate crisis. Those who are so much more exposed and vulnerable to its impacts have done least to contribute to the greenhouse gas emissions that are causing it. The UK has a moral responsibility here, not only because of its disproportionately high historic emissions, but as hosts of next year's critical UN climate summit. We need to go further and faster in reaching net zero."



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World governments are meeting virtually for the 75th UN general assembly this week, with the climate crisis high on the agenda. Boris Johnson, the UK prime minister, is expected to set out his vision for the next UN climate summit, called Cop26 and to be convened in Glasgow in November 2021, after the coronavirus crisis forced a year's delay to the event.

As host nation, the UK government is being urged to set out its plans for reaching net-zero emissions by 2050, a target enshrined in law last year, but for which there are still few national policies.

theguardian.com, 21 September 2020

<https://www.theguardian.com>

### Trojan horse nanoparticle takes a drug-free approach to killing cancer

2020-09-23

With cancer so often presenting as a cunning enemy, scientists are working hard to develop therapies that can slip through its array of crafty defenses. These types of "Trojan horse" approaches use all kinds of trickery to sneak drugs into cancer cells to kill them off, but a team from Singapore's Nanyang Technological University (NTU) is putting forward another solution, demonstrating how a new drug-free nanoparticle can do all the heavy lifting on its own.

Cancer cells employ all kinds of methods to evade and overcome the body's immune system, but they do have their weaknesses. Like many types of cells, they need amino acids to grow, and one they can't do without is called L-phenylalanine, which is typically absorbed into the body from meat and dairy products.

The NTU researchers sought to take advantage of this dependency, by using L-phenylalanine as their Trojan horse. This peptide was used to coat a cancer-fighting nanoparticle 30,000 times smaller than a human hair, the idea being this disguise could help the nanoparticle sneak into the cancer cells and cause them to self-destruct.

Called Nanoscopic phenylalanine Porous Amino Acid Mimic, or Nano-pPAAM, this nanoparticle was put to the test against cancer cells in the lab through experiments in vitro and in mice. The researchers found the approach killed around 80 percent of breast, skin and gastric cancer

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cells, which they point out is similar to what you'd expect from standard chemotherapy drugs.

"Against conventional wisdom, our approach involved using the nanomaterial as a drug instead as a drug-carrier," says lead author of the study Professor Dalton Tay. "Here, the cancer-selective and killing properties of Nano-pPAAM are intrinsic and do not need to be 'activated' by any external stimuli. The amino acid L-phenylalanine acts as a 'trojan horse' – a cloak to mask the nanotherapeutic on the inside."

Nano-pPAAM works by entering the cancer cells through an amino acid transporter cell and, once inside, stimulates the production of molecules known as reactive oxygen species (ROS), which don't harm healthy cells, but do cause the cancer cells to self-destruct. The major benefit of the technique is that it could overcome common issues with cancer cells developing resistance to drugs, which often sees them gain the upper hand.

"This novel approach could hold much promise for cancer cells that have failed to respond to conventional treatment like chemotherapy," says Associate Professor Tan Ern Yu, a breast cancer specialist at Tan Tock Seng Hospital, who was not involved with the study. "Such cancers often have evolved mechanisms of resistance to the drugs currently in use, rendering them ineffective. However, the cancer cells could potentially still be susceptible to the 'Trojan horse' approach since it acts through a completely different mechanism – one that the cells will not have adapted to."

The team is now working to fine-tune the technique to improve its efficacy and enable it to better target certain cancer types. The researchers are also investigating how it could be combined with other therapies such as immunotherapy to act as a one-two punch.

The research was published in the journal Small, while the video below provides an overview of the study.

newatlas.com, 23 September 2020

<https://www.newatlas.com>

**For comparison, all three of those extreme lows sneak past the average temperature on Mars, which is roughly minus 81 F (minus 63 C), according to NASA.**



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**Climate scientists uncover new record-low temperature in Greenland**

2020-09-25

On the heels of the hottest summer the Northern Hemisphere has ever seen, U.N. researchers digging through the climate record have reported a chilling discovery: On Dec. 22, 1991, a remote weather station atop the Greenland ice sheet recorded a temperature of minus 93.3 degrees Fahrenheit (minus 69.6 degrees Celsius) — the coldest temperature ever recorded in the Northern Hemisphere.

The frigid new record, announced Wednesday (Sept. 23) in a statement from the U.N.'s World Meteorological Organization (WMO), shivers past the previous record of minus 90.4 F (minus 67.8 C) set in two different towns in the Siberian Arctic, first in 1892 and the other in 1933. For comparison, all three of those extreme lows sneak past the average temperature on Mars, which is roughly minus 81 F (minus 63 C), according to NASA.

"In the era of climate change ... this newly recognized cold record is an important reminder about the stark contrasts that exist on this planet," WMO Secretary-General Petteri Taalas said in the statement.

Contrasting those lows, of course, are extreme highs that continue to set scorching new records year after year, thanks to global warming. In Verkhoyansk, for example — one of the Siberian towns that witnessed the former record-low in 1892 — temperatures reached 100 F (38 C) this June for the first time in recorded history, setting a new record-high temperature for the Arctic Circle.

Meanwhile, Antarctica — which still holds the world record for coldest temperature on Earth (minus 128.6 F, or minus 89.2 C, recorded in 1983) — saw a new all-time high this February, when temperatures reached 69.35 F (20.75 C) during the Southern Hemisphere's summer.

Greenland's new record low was discovered by a team of so-called "climate detectives" working at the WMO's Archive of Weather and Climate Extremes in Geneva. The temperature was recorded by the Klinck automatic weather station, which was active from 1990 to 1992 near the highest peak of the Greenland ice sheet, according to AP News. The WMO detectives confirmed these results with the original Klinck researchers before making their announcement on Wednesday. Formed in 2007, the WMO Archive has uncovered a slew of similar meteorological records over the years. In June 2020, Archive researchers announced the discovery

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of the longest lightning bolt ever recorded — a 440-mile-long (700 kilometers) bolt that stretched across Brazil and Argentina on Halloween, 2018. What could be spookier than that?

*Originally published on Live Science.*

livescience.com, 25 September 2020

<https://www.livescience.com>

**Hawaiian reefs lost almost half their fish to pollution and fishing**

2020-09-21

A healthy coral reef system is like a well-managed city. Each resident fish has a job in maintaining the reef: some nibble away at seaweed threatening to smother the coral, while others crunch through bits of coral, making space for new polyps. In turn, the reef provides food and a refuge where fish can sleep, reproduce, and hide from predators. These relationships are symbiotic: the fish help the reef, and the reef helps the fish.

But when fish disappear from a coral reef due to fishing or pollution, the system is thrown out of balance, and a reef may deteriorate to the point of collapse, especially when coral bleaching and other climate change-induced factors are thrown into the mix. This is exactly what's happening to the coral reefs in West Hawai'i, the western shoreline of Hawai'i's Big Island known as the Kona coast, according to a new study.

Published last month in *Ecological Applications*, the study investigates how human activities, such as fishing, aquarium collection and pollution, affect so-called resource fishes that live in the shallow waters along the reef. The study defines resource fish as species that are "important to local subsistence or cultural sectors," such as by providing food or income. Overall, it documented a 45% decrease in resource fish biomass across West Hawai'i's reefs between 2008 and 2018.

"A 45% decline in 10 years is very alarming," said Greg Asner, co-author of the study and director of the Center for Global Discovery and Conservation Science at Arizona State University (ASU), a program with which Mongabay is developing a partnership.

For the study, Asner and his colleagues analyzed fish survey data collected by the Hawai'i Division of Aquatic Resources (DAR), which manages the state's fisheries and reef systems, between 2008 and 2018 at 300

**Overall, it documented a 45% decrease in resource fish biomass across West Hawai'i's reefs between 2008 and 2018.**



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sites across 180 kilometers (112 miles) of coastline. They also used data obtained from ASU's Global Airborne Observatory, a laboratory aboard an airplane that captures 3D images of coral reefs beneath the water, and calculated the amount of nitrogen pollution from onsite sewage disposal systems and golf courses that reached the reefs.

For the most part, West Hawai'i's coastal waters are organized into different types of marine protected areas (MPA), each of which follows distinct regulations. Some just ban lay nets, vertical nets that hang across the water column and indiscriminately capture any fish that swim into them. Others ban both lay nets and collection of live fish for the aquarium trade, and several ban lay nets, aquarium collection and spearfishing. There are only a few MPAs that completely prohibit the taking of fish. By analyzing the fish survey data across these different types of MPAs, the researchers were able to distinguish how various human activities influenced fish biomass on the reefs, Asner said.

According to the study, nitrogen-based pollution from onsite sewage disposal systems (OSDS) such as cesspools, septic tanks and injection wells had the biggest negative impact on fish biomass, and to a lesser extent, nutrient runoff from golf courses. But spearfishing, aquarium collection and the use of lay nets followed closely behind, Asner said. MPAs that banned all three activities had the highest overall fish biomass.

The research team was also able to determine how certain equipment bans may have influenced fish populations. For instance, in 2013, the DAR banned scuba diving-assisted spearfishing. As a result, populations of the "scraper" species that spearfishers typically target (fish that eat algae and bits of coral reef), such as parrotfish, appeared to recover slightly.

The decline in fish biomass is concerning as it can lead to a decline in reef health, according to Asner.

"You've got to close your eyes and picture this: when you have a healthy reef, you have lots of coral ... and it makes these towers of all shapes and sizes," Asner said. "If you have a decline in fish, and the coral dies, then waves and nature will just erode it like soil back to more of a flat surface. Then there's a negative feedback loop when the fish can't ... use the coral as its habitat."

Brian Nielson, the DAR administrator, told Mongabay that the new study reinforces the department's existing concerns about the health of Hawai'i's coral reefs. "I guess it wasn't a big surprise, but it is great to be able to look at a big picture view of the reefs," he said.

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The findings, Nielson said, could help inform the development of new policies, such as increasing protections for herbivorous reef fish, strengthening state rules and regulations around the reporting of commercial catches, and improving enforcement, all the while collaborating with local communities to co-manage fisheries. Nielson said that managing pollution issues is beyond the division's capacity and jurisdiction, but it currently has partnerships with groups that are addressing sewage issues and working to restore degraded watersheds.

Nielson said another path toward protecting Hawai'i's coral reef systems is the state's 30 by 30 [Oceans Target](#), which aims to protect 30% of Hawai'i's nearshore waters by 2030.

"Six percent of our waters are designated as some form of marine managed areas, so we're looking at taking that up to 30%," Nielson said. "This paper is really helpful in scientifically validating the success of existing marine managed areas, so that kind of gives us some scientific backing when we go out to the public to propose expanding these areas, and putting more marine protection on other islands and other parts of the state."

[news.mongabay.com](https://www.news.mongabay.com), 21 September 2020

<https://www.news.mongabay.com>

### Hope for life on Venus survives for centuries against all odds

2020-09-25

If you're looking for an exemplar of mastering multiple identities, find a telescope and point it at Venus.

In both astronomy and popular culture, Venus has always assumed a diversity of guises. Morning star, evening star. Goddess. Planet. Frankie Avalon song. A plant that eats flies. And the realm ruled by women in the unforgettable film *Queen of Outer Space* (starring Zsa Zsa Gabor as the nemesis of the evil queen).

So it's not surprising that Venus enjoys sufficient celebrity status to warrant big-type headlines when it makes news, or at least a lot of social media hype. In the latest such instance, all it took was a whiff of a noxious gaseous chemical in the planet's clouds, hinting that Venus might harbor life, to stop the presses and start the tweetstorms. After all, life on Venus would be a big surprise. Scientists have long considered it the hell of

**After all, life on Venus would be a big surprise.**



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the solar system, hotter than molten lead and with an unbreathable atmosphere.

Yet, as it was so ably reported by Lisa Grossman for *Science News*, the chemical in question, phosphine, is no guarantee of life on Venus. It's just that the known nonbiologic ways to make phosphine do not seem plausible in the Venusian environment. Phosphine's persistence in the clouds shrouding Venus suggests something must be currently producing it — otherwise the sulfuric acid in the planet's upper atmosphere would have destroyed any signs of the gas by now. So phosphine might be a signal of life — perhaps some form of anaerobic bacteria (which do not require oxygen), as phosphine would be deadly to life that relied on oxygen.

## Bottom of Form

On the other hand, maybe there's just a gap in Earthling chemistry textbooks, and some weird geochemical reactions produce Venusian phosphine. That's probably a better bet than airborne anaerobic alien organisms. Phosphine as evidence of life on Venus may turn out to be as reliable as the famous "canals" once regarded as evidence for life on Mars.

Still, hope for life on Venus never dies. In centuries past, in fact, many scientists simply assumed that Venus possessed life. In the late 17th century, Bernard le Bovier de Fontenelle, a French popularizer of science, surmised Venus to be inhabited by a gallant race of lovers. "The climate is most favorable for love matches," he wrote. About the same time, the Dutch physicist and astronomer Christiaan Huygens contemplated life on Venus. Venusians would receive twice the light and heat from the sun as Earthlings do, he knew, but noted that Earth's tropics, though much hotter than northern lands, are successfully occupied by people. For that matter, Huygens believed much hotter Mercury to be populated as well, and that the Mercurians would no doubt consider Earth much too cold and dark to support life.

In the 19th century, spectroscopic examination of Venus suggested that its atmosphere was similar to Earth's, containing water vapor and oxygen. Since Earth's atmospheric composition owed so much to life, it seemed obvious that life — at least plants — must exist on Venus as well. "If there be oxygen in the atmosphere of Venus, then it would seem possible that there might be life on that globe not essentially different in character from some forms of life on the earth," astronomer Robert S. Ball wrote in his widely read late 19th century book *The Story of the Heavens*. "If water

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be present on the surface of Venus and if oxygen be a constituent of its atmosphere, we might expect to find in that planet a luxuriant tropical life."

As late as 1918, Svante Arrhenius, a Nobel chemistry laureate, estimated that water was especially abundant on Venus, with humidity six times the average on Earth. "We must therefore conclude that everything on Venus is dripping wet" — thereby accelerating the growth of vegetation, Arrhenius wrote.

But the early observations of Venus' atmosphere were crude. About a century ago, refined techniques at the Mount Wilson Observatory in California contradicted the previous findings; oxygen and water vapor actually seemed scarce in the Venusian clouds. (In fact, as spacecraft visiting Venus in recent decades have shown, the air there is nearly all carbon dioxide with a little bit of nitrogen, plus only slight traces of water.) "It may be that the exacting conditions for the origin of life have not been satisfied" on Venus, Charles E. St. John and Seth B. Nicholson wrote in 1922 in *the Astrophysical Journal*.

Of course, it was possible that conditions on the surface, hidden by the thick clouds, might still allow life to find a way.

"There is a possibility that the atmosphere of Venus is permeated with a finely divided dust, a possible product of intense volcanic activity, which would act as an excellent reflector of the sun's rays and would at the same time effectually conceal the surface," Isabel Lewis of the U.S. Naval Observatory wrote in *Science News-Letter*, the predecessor of *Science News*, in 1922. In 1926, the prominent astronomer Harlow Shapley maintained that in the solar system, Venus "more nearly fulfills the conditions [for life] than any planet other than the Earth.... But we cannot penetrate the dense covering of clouds and seek out the secrets of its surface."

In 1927, *Science News-Letter* writer Frank Thone surveyed the prospects for life on other planets and declared Venus "the darling of the solar system" (excepting Earth, of course). While Mars seemed "wry and withered," he wrote, "our sister Venus seems to have the vigor and sap of life in her."

Yet as Thone acknowledged, the thick atmosphere guarding Venus' surface from view made the question of life there unanswerable — probably, Thone guessed, for many generations.

And so today, the mystery remains unsolved. Phosphine sightings leave the question of whether Venus hosts life in a situation similar to that of Mars, long ago, when the newspaper publisher William Randolph Hearst



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(legend has it) cabled an astronomer asking for an article on the topic. "Is there life on Mars? Please cable one thousand words," Hearst wrote. To which the astronomer cabled back: "Nobody knows. Repeat 500 times."

sciencenews.org, 25 September 2020

<https://www.sciencenews.org>

### EPA questions science linking widely used pesticide to brain damage in children

2020-09-22

The Environmental Protection Agency (EPA) on Tuesday diminished studies linking a widely-used pesticide associated with brain damage in children, a move that could enable years of continued use of controversial chlorpyrifos.

In a Tuesday risk assessment released by the agency, the EPA argued that "despite several years of study, the science addressing neurodevelopmental effects remains unresolved."

Critics see it as the agency laying the groundwork to deny a petition filed by environmental groups years ago to ban the substance in the wake of a reversal under the Trump administration.

In 2016, agency scientists recommended banning chlorpyrifos, citing the health effects on farmworkers and children.

Scientists worry that it affects the human nervous system much like it attacks those of insects.

"There are all these studies that have been done of kids showing that chlorpyrifos harms their brains especially as they're young or fetuses as they're developing. The very young are at much greater susceptibility than older people, and also more exposed," said Erik Olsen with the Natural Resource Defense Council, one of the groups pursuing a ban.

The substance was banned for household use in 2000 after studies found children who had been exposed to it had lower IQs than those who were not. The pesticide has also been linked to learning and memory issues and prolonged nerve and muscle stimulation.

However, it is still used on a wide range of crops, including corn, soybeans and wheat and at orchards.

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Tuesday's risk assessment was spurred by litigation from environmental groups, and a judge ordered the EPA to make a decision on whether to ban it.

"They kicked the decision back to scientists and said they're reanalyzing it so that's how they got around the courts telling them to decide whether to ban it or not," said Nathan Donley, a senior scientist at the Center for Biological Diversity.

The final decision from the agency will come later, but Donley said the risk assessment shows they are unlikely to ban the substance. He suspects the agency will instead offer to limit its uses, a measure he said would be insufficient.

"With how toxic it is you can't mitigate the harm enough to make sure not really impacting people's lives and health and the environment," he said.

A number of states have banned chlorpyrifos in the absence of federal action. Democrats also introduced a bill to ban its use, though the legislation has not advanced.

thehill.com, 22 September 2020

<https://www.thehill.com>

### In 2016, agency scientists recommended banning chlorpyrifos, citing the health effects on farmworkers and children.



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### Kingfisher reports majority of textiles products free of phthalates, PFCs and HFCs

2020-09-17

UK headquartered multinational home improvement company, Kingfisher, has reported that, through product testing, it has found that almost all of its textiles range is free from the three chemical groups it pledged to remove by 2025 – phthalates, perfluorinated compounds (PFCs) and halogenated flame retardants (HFCs).

The company, which owns brands B&Q, Screwfix, Castorama and Brico Dépôt, said this year it has tested 80 products in its textiles range that it considered to be the highest risk of containing the substances and found that more than 93% were free from the three chemical groups.

Kingfisher made a series of commitments as part of its 2018 sustainable growth plan that aim to “help millions of customers have a greener, healthier home – one that is resource-efficient, uses planet-friendly materials and is free from harmful chemicals”.

The company’s roadmap focuses on removing long chain and short chain PFCs, a sub-group of the broader chemical group per- and polyfluoroalkyl substances (PFASs). However, it is also working to remove many other PFASs from its textile and footwear products, it said.

Speaking at last week’s Chemical Watch Global Business Summit Europe 2020, Kingfisher’s sustainable chemicals specialist, Oscar Benjamin, said the company is working with suppliers through education and training to phase out these high-priority chemicals from the remaining products.

In addition to textiles, Mr Benjamin said the company has also made progress on phasing out phthalates from plastics. This, he said, was because there are market alternatives that are widely used, but he did not elaborate on what these alternatives were. The company has been training its suppliers in Asia and Europe on how to provide accurate information on the chemicals used in its products, with a focus on plastics.

However, the company is having more trouble phasing out halogenated flame retardants. Mr Benjamin said this is because it is harder to find alternatives that meet various national legally required safety standards.

“Keeping products fire safe requires suppliers to plan the right combination of materials, product design and substances,” he said. The company’s approach to flame retardant substitution involves planning the best combination of these three attributes, he added.

**However, the company is having more trouble phasing out halogenated flame retardants.**

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### ‘Green’ chemicals

Mr Benjamin told delegates that Kingfisher has a number of green chemistries in the pipeline that are in the R&D stage. One objective of the company’s 2025 chemistry goals is to replace substances of high concern in its products with five ‘green’ chemicals.

The company told Chemical Watch that it is not yet publicly revealing what it considers to be a green chemical or what the compounds being developed are.

Kingfisher said that when it knows it has viable alternatives, it will share more information about them. However, at the moment, the development and use of these chemistries is commercially and competitively sensitive.

Mr Benjamin said in last week’s virtual conference that these chemicals look to be a “great fit to replace some of the chemicals we are trying to eliminate”. The company is currently at the stage of testing product samples, product trials and market testing, which will be the real test, he said.

Kingfisher has also committed to achieving transparency of harmful chemicals in key supply chains by 2020. The company said key supply chains include textiles and footwear, plastics and chemical products.

“We have made good progress and have improved our understanding of where higher risk chemicals are likely to be used. However, with a large supply chain and many products in our ranges, this process is taking time,” the company said.

“We have also learned that the chemicals found in products often vary and a similar product may contain different chemicals according to the materials, suppliers, sub-contractors or manufacturing sites,” it added.

chemicalwatch.com, 17 September 2020

<https://www.chemicalwatch.com>

### Could COVID-19 have escaped from a lab?

2020-09-09

In January, as she watched the news about a novel virus spreading out of control in China, Alina Chan braced for a shutdown. The molecular biologist at the Broad Institute of Harvard and MIT started stockpiling medicine and supplies. By the time March rolled around and a quarantine seemed imminent, she’d bought hundreds of dollars’ worth of fillets from

**How had this virus come out of nowhere and shut down the planet? Why was it so different? she asked herself.**



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her favorite fishmonger in Cambridge and packed them into her freezer. Then she began to ramp down her projects in the lab, isolating her experimental cells from their cultures and freezing them in small tubes.

As prepared as she was for the shutdown, though, she found herself unprepared for the frustration of being frozen out of work. She paced the walls of her tiny apartment feeling bored and useless. Chan has been a puzzle demon since childhood, which was precisely what she loved about her work—the chance to solve fiendishly difficult problems about how viruses operate and how, through gene therapy, they could be repurposed to help cure devastating genetic diseases. Staring out her window at the eerily quiet streets of her Inman Square neighborhood, she groaned at the thought that it could be months before she was at it again. Her mind wandered back to 2003, when she was a teenager growing up in Singapore and the first SARS virus, a close relative of this coronavirus, appeared in Asia. It hadn't been anything like this. That one had been relatively easy to corral. *How had this virus come out of nowhere and shut down the planet? Why was it so different?* she asked herself.

Then it hit her: The world's greatest puzzle was staring her in the face. Stuck at home, all she had to work with was her brain and her laptop. Maybe they were enough. Chan fired up the kettle for the first of what would become hundreds of cups of tea, stacked four boxes on her kitchen counter to raise her laptop to the proper height, pulled back her long dark hair, and began reading all of the scientific literature she could find on the coronavirus.

It wasn't long before she came across an article about the remarkable stability of the virus, whose genome had barely changed from the earliest human cases, despite trillions of replications. This perplexed Chan. Like many emerging infectious diseases, COVID-19 was thought to be zoonotic—it originated in animals, then somehow found its way into people. At the time, the Chinese government and most scientists insisted the jump had happened at Wuhan's seafood market, but that didn't make sense to Chan. If the virus had leapt from animals to humans in the market, it should have immediately started evolving to life inside its new human hosts. But it hadn't.

On a hunch, she decided to look at the literature on the 2003 SARS virus, which had jumped from civets to people. *Bingo*. A few papers mentioned its rapid evolution in its first months of existence. Chan felt the familiar surge of puzzle endorphins. The new virus really wasn't behaving like it should. Chan knew that delving further into this puzzle would require

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some deep genetic analysis, and she knew just the person for the task. She opened Google Chat and fired off a message to Shing Hei Zhan. He was an old friend from her days at the University of British Columbia and, more important, he was a computational god.

"Do you want to partner on a very unusual paper?" she wrote.

*Sure*, he replied.

One thing Chan noticed about the original SARS was that the virus in the first human cases was subtly different—a few dozen letters of genetic code—from the one in the civets. That meant it had immediately morphed. She asked Zhan to pull up the genomes for the coronaviruses that had been found on surfaces in the Wuhan seafood market. Were they at all different from the earliest documented cases in humans?

Zhan ran the analysis. Nope, they were 100 percent the same. Definitely from humans, not animals. The seafood-market theory, which Chinese health officials and the World Health Organization espoused in the early days of the pandemic, was wrong. Chan's puzzle detectors pulsed again. "Shing," she messaged Zhan, "this paper is going to be insane."

In the coming weeks, as the spring sun chased shadows across her kitchen floor, Chan stood at her counter and pounded out her paper, barely pausing to eat or sleep. It was clear that the first SARS evolved rapidly during its first three months of existence, constantly fine-tuning its ability to infect humans, and settling down only during the later stages of the epidemic. In contrast, the new virus looked a lot more like late-stage SARS. "It's almost as if we're missing the early phase," Chan marveled to Zhan. Or, as she put it in their paper, as if "it was already well adapted for human transmission."

That was a profoundly provocative line. Chan was implying that the virus was already familiar with human physiology when it had its coming-out party in Wuhan in late 2019. If so, there were three possible explanations.

Perhaps it was just staggeringly bad luck: The mutations had all occurred in an earlier host species, and just happened to be the perfect genetic arrangement for an invasion of humanity. But that made no sense. Those mutations would have been disadvantageous in the old host.

Maybe the virus had been circulating undetected in humans for months, working out the kinks, and nobody had noticed. Also unlikely. China's health officials would not have missed it, and even if they had, they'd be



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able to go back now through stored samples to find the trail of earlier versions. And they weren't coming up with anything.

That left a third possibility: The missing phase had happened in a lab, where the virus had been trained on human cells. Chan knew this was the third rail of potential explanations. At the time, conspiracy theorists were spinning bioweapon fantasies, and Chan was loath to give them any ammunition. But she also didn't want to play politics by withholding her findings. Chan is in her early thirties, still at the start of her career, and an absolute idealist about the purity of the scientific process. Facts were facts.

Or at least they used to be. Since the start of the pandemic, the Trump administration has been criticized for playing fast and loose with facts—denying, exaggerating, or spinning them to suit the president's political needs. As a result, many scientists have learned to censor themselves for fear that their words will be misrepresented. Still, Chan thought, if she were to sit on scientific research just to avoid providing ammunition to conspiracy theorists or Trump, would she be any better than them?

Chan knew she had to move forward and make her findings public. In the final draft of her paper, she torpedoed the seafood-market theory, then laid out a case that the virus seemed curiously well adapted to humans. She mentioned all three possible explanations, carefully wording the third to emphasize that if the novel coronavirus did come from a lab, it would have been the result of an accident in the course of legitimate research.

On May 2, Chan uploaded the paper to a site where as-yet-unpublished biology papers known as "preprints" are shared for open peer review. She tweeted out the news and waited. On May 16, the *Daily Mail*, a British tabloid, picked up her research. The very next day, *Newsweek* ran a story with the headline "Scientists Shouldn't Rule Out Lab as Source of Coronavirus, New Study Says."

And that, Chan says, is when "shit exploded everywhere."

**Chan had come** to my attention a week before the *Newsweek* story was published through her smart and straightforward tweets, which I found refreshing at a time when most scientists were avoiding any serious discussion about the possibility that COVID-19 had escaped from a biolab. I'd written a lot about genetic engineering and so-called gain-of-function research—the fascinating, if scary, line of science in which scientists alter viruses to make them more transmissible or lethal as a way of assessing how close those viruses are to causing pandemics. I also knew that deadly pathogens escape from biolabs with surprising frequency. Most of

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these accidents end up being harmless, but many researchers have been infected, and people have died as a result.

For years, concerned scientists have warned that this type of pathogen research was going to trigger a pandemic. Foremost among them was Harvard epidemiologist Marc Lipsitch, who founded the Cambridge Working Group in 2014 to lobby against these experiments. In a series of policy papers, op-eds, and scientific forums, he pointed out that accidents involving deadly pathogens occurred more than twice a week in U.S. labs, and estimated that just 10 labs performing gain-of-function research over a 10-year period would run a nearly 20 percent risk of an accidental release. In 2018, he argued that such a release could "lead to global spread of a virulent virus, a biosafety incident on a scale never before seen."

Thanks in part to the Cambridge Working Group, the federal government briefly instituted a moratorium on such research. By 2017, however, the ban was lifted and U.S. labs were at it again. Today, in the United States and across the globe, there are dozens of labs conducting experiments on a daily basis with the deadliest known pathogens. One of them is the Wuhan Institute of Virology. For more than a decade, its scientists have been discovering coronaviruses in bats in southern China and bringing them back to their lab in Wuhan. There, they mix genes from different strains of these novel viruses to test their infectivity in human cells and lab animals.

When word spread in January that a novel coronavirus had caused an outbreak in Wuhan—which is a thousand miles from where the bats that carry this lineage of viruses are naturally found—many experts were quietly alarmed. There was no proof that the lab was the source of the virus, but the pieces fit.

Despite the evidence, the scientific community quickly dismissed the idea. Peter Daszak, president of EcoHealth Alliance, which has funded the work of the Wuhan Institute of Virology and other labs searching for new viruses, called the notion "preposterous," and many other experts echoed that sentiment.

That wasn't necessarily what every scientist thought in private, though. "They can't speak directly," one scientist told me confidentially, referring to the virology community's fear of having their comments sensationalized in today's politically charged environment. "Many virologists don't want to be hated by everyone in the field."



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There are other potential reasons for the pushback. There's long been a sense that if the public and politicians really knew about the dangerous pathogen research being conducted in many laboratories, they'd be outraged. Denying the possibility of a catastrophic incident like this, then, could be seen as a form of career preservation. "For the substantial subset of virologists who perform gain-of-function research," Richard Ebright, a Rutgers microbiologist and another founding member of the Cambridge Working Group, told me, "avoiding restrictions on research funding, avoiding implementation of appropriate biosafety standards, and avoiding implementation of appropriate research oversight are powerful motivators." Antonio Regalado, biomedicine editor of *MIT Technology Review*, put it more bluntly. If it turned out COVID-19 came from a lab, he tweeted, "it would shatter the scientific edifice top to bottom."

That's a pretty good incentive to simply dismiss the whole hypothesis, but it quickly amounted to a global gaslighting of the media—and, by proxy, the public. An unhealthy absolutism set in: Either you insisted that any questions about lab involvement were absurd, or you were a tool of the Trump administration and its desperation to blame China for the virus. I was used to social media pundits ignoring inconvenient or politically toxic facts, but I'd never expected to see that from some of our best scientists.

Which is why Chan stood out on Twitter, daring to speak truth to power. "It is very difficult to do research when one hypothesis has been negatively cast as a conspiracy theory," she wrote. Then she offered some earnest advice to researchers, suggesting that most viral research should be done with neutered viruses that have had their replicating machinery removed in advance, so that even if they escaped confinement, they would be incapable of making copies of themselves. "When these precautions are not followed, risk of lab escape is exponentially higher," she explained, adding, "I hope the pandemic motivates local ethics and biosafety committees to think carefully about how they can reduce risk." She elaborated on this in another tweet several days later: "I'd also—personally—prefer if high biosafety level labs were not located in the most populous cities on earth."

Chan had started using her Twitter account this intensely only a few days earlier, as a form of outreach for her paper. The social platform has become the way many scientists find out about one another's work, and studies have shown that attention on Twitter translates to increased citations for a paper in scientific literature. But it's a famously raw forum. Many scientists are not prepared for the digital storms that roil the Twitterverse, and they don't handle it well. Chan dreaded it at first, but quickly took to Twitter like

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a digital native. "Having Twitter elevates your work," she says. "And I think it's really fun to talk to nonscientists about that work."

After reading her tweets, I reviewed her preprint, which I found mind-blowing, and wrote her to say so. She thanked me and joked that she worried it might be "career suicide."

It wasn't long before it began to look like she might be right.

**Speaking her mind**, it turns out—even in the face of censure—was nothing new for Chan, who is Canadian but was raised in Singapore, one of the more repressive regimes on earth. Her parents, both computer science professionals, encouraged free thinking and earnest inquiry in their daughter, but the local school system did not. Instead, it was a pressure-cooker of a system that rewarded students for falling in line, and moved quickly to silence rebels.

That was a bad fit for Chan. "You have to bow to teachers," she says. "Sometimes teachers from other classes would show up and ask me to bow to them. And I would say, 'No, you're not my teacher.' Back then they believed in corporal punishment. A teacher could just take a big stick and beat you in front of the class. I got whacked so many times."

Still, Chan rebelled in small ways, skipping school and hanging out at the arcade. She also lost interest in her studies. "I just really didn't like school. And I didn't like all the extracurriculars they pack you with in Singapore," she says. That changed when a teacher recruited her for math Olympiads, in which teams of students compete to solve devilishly hard arithmetic puzzles. "I really loved it," she says. "You just sit in a room and think about problems."

Chan might well have pursued a career in math, but then she came up against teams from China in Olympiad competitions. "They would just wipe everyone else off the board," she says. "They were machines. They'd been trained in math since they could walk. They'd hit the buzzer before you could even comprehend the question. I thought, *I'm not going to survive in this field.*"

Chan decided to pursue biology instead, studying at the University of British Columbia. "I liked viruses from the time I was a teen," she says. "I remember the first time I learned about HIV. I thought it was a puzzle and a challenge." That instinct took her to Harvard Medical School as a postdoc, where the puzzle became how to build virus-like biomolecules to accomplish tasks inside cells, and then to Ben Deverman's lab at the Broad



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Institute. “When I see an interesting question, I want to spend 100 percent of my time working on it,” she says. “I get really fixated on answering scientific questions.”

Deverman, for his part, says he wasn’t actively looking to expand his team when Chan came along, but when “opportunities to hire extraordinary people fall in my lap,” he takes them. “Alina brings a ton of value to the lab,” he explains, adding that she has an ability to pivot between different topics and cut to the chase. Nowhere was that more on display than with her coronavirus work, which Deverman was able to closely observe. In fact, Chan ran so many ideas past him that he eventually became a coauthor. “She is insightful, determined, and has the rare ability to explain complex scientific findings to other scientists and to the public,” he says.

Those skills would prove highly useful when word got out about her coronavirus paper.

**If Chan had** spent a lifetime learning how to pursue scientific questions, she spent most of the shutdown learning what happens when the answers you come up with are politically radioactive. After the *Newsweek* story ran, conservative-leaning publications seized on her paper as conclusive evidence that the virus had come from a lab. “Everyone focused on the one line,” Chan laments. “The tabloids just zoomed in on it.” Meanwhile, conspiracists took it as hard evidence of their wild theories that there had been an intentional leak.

Chan spent several exhausting days putting out online fires with the many people who had misconstrued her findings. “I was so naive,” she tells me with a quick, self-deprecating laugh. “I just thought, *Shouldn’t the world be thinking about this fairly?* I really have to kick myself now.”

Even more troubling, though, were the reactions from other scientists. As soon as her paper got picked up by the media, luminaries in the field sought to censure her. Jonathan Eisen, a well-known professor at UC Davis, criticized the study in *Newsweek* and on his influential Twitter account, writing, “Personally, I do not find the analysis in this new paper remotely convincing.” In a long thread, he argued that comparing the new virus to SARS was not enough to show that it was preadapted to humans. He wanted to see comparisons to the initial leap of other viruses from animals to humans.

Moments later, Daszak piled on. The NIH had recently cut its grant to his organization, EcoHealth Alliance, after the Trump administration learned that some of it had gone to fund the Wuhan Institute of Virology’s work.

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Daszak was working hard to get it restored and trying to stamp out any suggestion of a lab connection. He didn’t hold back on Chan. “This is sloppy research,” he tweeted, calling it “a poorly designed phylogenetic study with too many inferences and not enough data, riding on a wave of conspiracy to drive a higher impact.” Peppering his tweets with exclamation points, he attacked the wording of the paper, arguing that one experiment it cited was impossible, and told Chan she didn’t understand her own data. Afterward, a Daszak supporter followed up his thread with a GIF of a mike drop.

It was an old and familiar dynamic: threatened silverback male attempts to bully a junior female member of the tribe. As a postdoc, Chan was in a vulnerable position. The world of science is still a bit medieval in its power structure, with a handful of institutions and individuals deciding who gets published, who gets positions, who gets grants. There’s little room for rebels.

What happened next was neither old nor familiar: Chan didn’t back down. “Sorry to disrupt mike drop,” she tweeted, providing a link to a paper in the prestigious journal *Nature* that “does that exact experiment you thought was impossible.” Politely but firmly, she justified each point Daszak had attacked, showing him his mistakes. In the end, Daszak was reduced to arguing that she had used the word “isolate” incorrectly. In a coup de grâce, Chan pointed out that actually the word had come from online data provided by GenBank, the NIH’s genetic sequence database. She offered to change it to whatever made sense. At that point, Daszak stopped replying. He insists, however, that Chan is overinterpreting her findings.

With Eisen, Chan readily agreed to test her hypothesis by finding other examples of viruses infecting new hosts. Within days, a perfect opportunity came along when news broke that the coronavirus had jumped from humans to minks at European fur farms. Sure enough, the mink version began to rapidly mutate. “You actually see the rapid evolution happening,” Chan said. “Just in the first few weeks, the changes are quite drastic.”

Chan also pointed out to Eisen that the whole goal of a website such as bioRxiv (pronounced “bioarchive”)—where she posted the paper—is to elicit feedback that will make papers better before publication. Good point, he replied. Eventually he conceded that there was “a lot of interesting analysis in the paper” and agreed to work with Chan on the next draft.



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The Twitter duels with her powerful colleagues didn't rattle Chan. "I thought Jonathan was very reasonable," she says. "I really appreciated his expertise, even if he disagreed with me. I like that kind of feedback. It helped to make our paper better."

With Daszak, Chan is more circumspect. "Some people have trouble keeping their emotions in check," she says. "Whenever I saw his comments, I'd just think, *Is there something I can learn here? Is there something he's right about that I should be fixing?*" Ultimately, she decided, there was not.

**By late May**, both journalists and armchair detectives interested in the mystery of the coronavirus were discovering Chan as a kind of Holmes to our Watson. She crunched information at twice our speed, zeroing in on small details we'd overlooked, and became a go-to for anyone looking for spin-free explications of the latest science on COVID-19. It was thrilling to see her reasoning in real time, a reminder of why I've always loved science, with its pursuit of patterns that sometimes leads to exciting revelations. The website CNET featured her in a story about "a league of scientists-turned-detectives" who were using genetic sequencing technologies to uncover COVID-19's origins. After it came out, Chan added "scientist-turned-detective" to her Twitter bio.

She's lived up to her new nom de tweet. As the search for the source of the virus continued, several scientific teams published papers identifying a closely related coronavirus in pangolins—anteater-like animals that are heavily trafficked in Asia for their meat and scales. The number of different studies made it seem as though this virus was ubiquitous in pangolins. Many scientists eagerly embraced the notion that the animals might have been the intermediate hosts that had passed the novel coronavirus to humans. It fit their preexisting theories about wet markets, and it would have meant no lab had been involved.

As Chan read the pangolin papers, she grew suspicious. The first one was by a team that had analyzed a group of the animals intercepted by anti-smuggling authorities in southern China. They found the closely related virus in a few of them, and published the genomes for that virus. Some of the other papers, though, were strangely ambiguous about where their data was coming from, or how their genomes had been constructed. Had they really taken samples from actual pangolins?

Once again, Chan messaged Shing Hei Zhan. "Shing, something's weird here," she wrote. Zhan pulled up the raw data from the papers and compared the genomes they had published. Individual copies of a virus coming from different animals should have small differences, just as

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individuals of a species have genetic differences. Yet the genomes in all of the pangolin papers were perfect matches—the authors were all simply using the first group's data set. Far from being ubiquitous, the virus had been found only in a few pangolins who were held together, and it was unclear where they had caught it. The animals might have even caught it from their own smuggler.

Remarkably, one group of authors in *Nature* even appeared to use the same genetic sequences from the other paper as if it were confirmation of their own discovery. "These sequences appear to be from the same virus (Pangolin-CoV) that we identified in the present study."

Chan called them out on Twitter: "Of course it's the same Pangolin-CoV, you used the same dataset!" For context, she later added, "Imagine if clinical trials were playing fast and loose with their patient data; renaming patients, throwing them into different datasets without clarification, possibly even describing the same patient multiple times across different studies unintentionally."

She and Zhan posted a new preprint on bioRxiv dismantling the pangolin papers. Confirmation came in June when the results of a study of hundreds of pangolins in the wildlife trade were announced: Not a single pangolin had any sign of a coronavirus. Chan took a victory lap on Twitter: "Supports our hypothesis all this time." The pangolin theory collapsed.

Chan then turned her Holmesian powers on bigger game: Daszak and the Wuhan Institute of Virology. Daszak had been pleading his case everywhere from *60 Minutes* to the *New York Times* and has been successful in rallying sympathy to his cause, even getting 77 Nobel laureates to sign a letter calling for the NIH to restore EcoHealth Alliance's funding.

In several long and detailed "tweeterials," Chan began to cast a cloud of suspicion on the WIV's work. She pointed out that scientists there had discovered a virus that is more than 96 percent identical to the COVID-19 coronavirus in 2013 in a mineshaft soon after three miners working there had died from a COVID-like illness. The WIV didn't share these findings until 2020, even though the goal of such work, Chan pointed out, was supposedly to identify viruses with the potential to cause human illnesses and warn the world about them.

Even though that virus had killed three miners, Daszak said it wasn't considered a priority to study at the time. "We were looking for SARS-related virus, and this one was 20 percent different. We thought it was interesting, but not high risk. So we didn't do anything about it and



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put it in the freezer," he told a reporter from *Wired*. It was only in 2020, he maintained, that they started looking into it once they realized its similarity to COVID-19. But Chan pointed to an online database showing that the WIV had been genetically sequencing the mine virus in 2017 and 2018, analyzing it in a way they had done in the past with other viruses in preparation for running experiments with them. Diplomatic yet deadpan, she wrote, "I think Daszak was misinformed."

For good measure, almost in passing, Chan pointed out a detail no one else had noticed: COVID-19 contains an uncommon genetic sequence that has been used by genetic engineers in the past to insert genes into coronaviruses without leaving a trace, and it falls at the exact point that would allow experimenters to swap out different genetic parts to change the infectivity. That same sequence can occur naturally in a coronavirus, so this was not irrefutable proof of an unnatural origin, Chan explained, "only an observation." Still, it was enough for one Twitter user to muse, "If capital punishment were as painful as what Alina Chan is doing to Daszak/WIV regarding their story, it would be illegal."

Daszak says that indeed he had been misinformed and was unaware that that virus found in the mine shaft had been sequenced before 2020. He also says that a great lab, with great scientists, is now being picked apart to search for suspicious behavior to support a preconceived theory. "If you believe, deep down, something fishy went on, then what you do is you go through all the evidence and you try to look for things that support that belief," he says, adding, "That is not how you find the truth."

Many of the points in Chan's tweetorials had also been made by others, but she was the first reputable scientist to put it all together. That same week, London's *Sunday Times* and the BBC ran stories following the same trail of breadcrumbs that Chan had laid out to suggest that there had been a coverup at the WIV. The story soon circulated around the world. In the meantime, the WIV has steadfastly denied any viral leak. Lab director Yanyi Wang went on Chinese television and described such charges as "pure fabrication," and went on to explain that the bat coronavirus from 2013 was so different than COVID that it could not have evolved into it this quickly and that the lab only sequenced it and didn't obtain a live virus from it.

To this day, there is no definitive evidence as to whether the virus occurred naturally or had its origins in a lab, but the hypothesis that the Wuhan facility was the source is increasingly mainstream and the science behind it can no longer be ignored. And Chan is largely to thank for that.

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**In late spring**, Chan walked through the tall glass doors of the Broad Institute for the first time in months. As she made her way across the gleaming marble foyer, her sneaker squeaks echoed in the silence. It was like the zombie apocalypse version of the Broad; all the bright lights but none of the people. It felt all the weirder that she was wearing her gym clothes to work.

A few days earlier, the Broad had begun letting researchers back into their labs to restart their projects. All computer work still needed to be done remotely, but bench scientists such as Chan could pop in just long enough to move along their cell cultures, provided they got tested for the virus every four days.

In her lab, Chan donned her white lab coat and took inventory, throwing out months of expired reagents and ordering new materials. Then she rescued a few samples from the freezer, took her seat at one of the tissue-culture hoods—stainless steel, air-controlled cabinets in which cell engineers do their work—and began reviving some of her old experiments.

She had mixed emotions about being back. It felt good to free her gene-therapy projects from their stasis, and she was even more excited about the new project she and Deverman were working on: an online tool that allows vaccine developers to track changes in the virus's genome by time, location, and other characteristics. "It came out of my personal frustration at not being able to get answers fast," she says.

On the other hand, she missed being all-consuming by her detective work. "I wanted to stop after the pangolin preprint," she says, "but this mystery keeps drawing me back in." So while she waits for her cell cultures to grow, she's been sleuthing on the side—only this time she has more company: Increasingly, scientists have been quietly contacting her to share their own theories and papers about COVID-19's origins, forming something of a growing underground resistance. "There's a lot of curiosity," she says. "People are starting to think more deeply about it." And they have to, she says, if we are going to prevent future outbreaks: "It's really important to find out where this came from so it doesn't happen again."

That is what keeps Chan up at night—the possibility of new outbreaks in humans from the same source. If the virus emerged naturally from a bat cave, there could well be other strains in existence ready to spill over. If they are closely related, whatever vaccines we develop might work on them, too. But that might not be the case with manipulated viruses from a laboratory. "Someone could have been sampling viruses from different



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caves for a decade and just playing mix-and-match in the lab, and those viruses could be so different from one another that none of our vaccines will work on them," she says. Either way, "We need to find where this came from, and close it down."

Whatever important information she finds, we can be sure Chan will share it with the world. Far from being shaken by the controversy her paper stirred, she is more committed than ever to holding a line that could all too easily be overrun. "Scientists shouldn't be censoring themselves," she says. "We're obliged to put all the data out there. We shouldn't be deciding that it's better if the public doesn't know about this or that. If we start doing that, we lose credibility, and eventually we lose the public's trust. And that's not good for science." In fact, it would cause an epidemic of doubt, and that wouldn't be good for any of us.

bostonmagazine.com, 9 September 2020

<https://www.bostonmagazine.com>

### What's really in your bottled water?

2020-09-24

CR recently tested 47 bottled waters, including 35 noncarbonated and 12 carbonated ones. For each product, we tested two to four samples. The tests focused on four heavy metals (arsenic, cadmium, lead, and mercury), plus 30 PFAS chemicals, which pose special concerns because they can linger in the environment almost indefinitely.

The federal government has issued only voluntary guidance for PFAS, saying the combined amounts for two specific PFAS compounds should be below 70 parts per trillion. A few states have set lower limits, of 12 to 20 ppt, according to American Water Works, an industry group. The International Bottled Water Association, another group, says that it supports federal limits for PFAS and that bottled water should have PFAS levels below 5 ppt for any single compound and 10 ppt for more than one. Some experts say the cutoff for total PFAS levels should be even lower, 1 ppt.

#### Noncarbonated Water

Most of the noncarbonated products CR tested had detectable levels of PFAS, but only two—Tourmaline Spring and Deer Park—exceeded 1 part per trillion.

**Most of the noncarbonated products CR tested had detectable levels of PFAS, but only two—Tourmaline Spring and Deer Park—exceeded 1 part per trillion.**

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Tourmaline Spring says the amount of PFAS in its bottled water is below the levels set by the IBWA and all states. Nestlé, which makes Deer Park, says that its most recent testing for the brand indicated undetectable levels of PFAS.

All noncarbonated water that CR tested had heavy metal levels well below federal safety limits, with one exception: Starkey Spring Water, owned by Whole Foods. It had arsenic levels just shy of the federal limit of 10 parts per billion and more than three times as much as CR's recommended level of 3 ppb.

The company's "highest priority is to provide customers with safe, high-quality, and refreshing spring water," Whole Foods says. "These products meet all FDA requirements and are fully compliant with FDA standards for heavy metals."

#### Carbonated Water

All carbonated water that CR tested fell below legal limits for heavy metals, and none had arsenic levels above CR's recommended maximum of 3 parts per billion. But many products had measurable amounts of PFAS.

There are a few possible reasons. Phil Brown, at the PFAS Project Lab at Northeastern University in Boston, says the carbonation process could be a factor. The source water could also have more PFAS, or treatment used by some brands doesn't remove PFAS to below 1 part per trillion.

CR heard back from all companies with PFAS levels above 1 ppt, except for Buby. La Croix and Canada Dry said levels in their products were well below current standards or requirements. Topo Chico, made by Coca-Cola and with the highest PFAS levels in CR's tests, said it would "continue to make improvements to prepare for more stringent standards in the future." Nestlé, maker of Poland Spring and Perrier, said that its recent testing did not detect PFAS and that it supports efforts to set federal limits. LaCroix and Polar challenged how CR arrived at our total PFAS amounts. For details, read CR's methodology for testing bottled water (PDF).

Brian Ronholm, CR's director of food policy, says that PFAS in carbonated water highlights the need for the federal government to set science-based limits for PFAS compounds in tap and bottled drinking water. "The fact that so many brands had total PFAS below 1 ppt shows it is feasible to get to more protective levels," he says.

**Editor's Note:** This article also appeared in the November 2020 issue of Consumer Reports magazine. Bottled water testing for this project was



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made possible by the Forsythia Foundation, an organization focused on promoting public health and reducing chemical exposure.

consumerreports.org, 24 September 2020

<https://www.consumerreports.org>

### The murky case for mass telecommuting

2020-09-26

Predictions that telecommuting will transform the workplace have been around since the term was coined in 1973. But with as much as half of the U.S. workforce clocking in from home amid the pandemic, this time really could be different. Many employers have indicated that their relaxed work-from-home policies will outlast Covid-19, and several tech giants, including Facebook, Twitter and Google, have blessed workers going permanently remote.

Now an influential body of urban planners is aiming to capitalize on the trend — by mandating it. During its September 23 meeting, the Metropolitan Transportation Commission, a regional authority that finances and coordinates local mobility plans in California's Bay Area, set a requirement that large office-based employers should have at least 60% of their employees work remotely on any given workday by 2050. The remote-work order is one of 35 strategies in Plan Bay Area 2050, the group's 30-year roadmap to guide regional transportation funding, as required by state and federal law. The work-from-home directive aims to bring the region's climate-changing carbon emissions down.

The 60% benchmark for office workers was designed to bring the telecommute share of the region's overall workforce as high as 25%, Matt Maloney, the commission's regional planning director, said during the meeting. With a goal to achieve a 19% reduction in per capita greenhouse gases by 2035, the blueprint's strategies "must be ones that local governments are poised to deliver," he said. The telecommuting strategy, Maloney said later, was "one of the most necessary pieces."

Yet the idea of forcing roughly one million commuters to stay home on a typical workday as a response to climate change raised significant concerns among attendees. Nick Josefowitz, an MTC commissioner who works as the director of policy at the urbanism think tank SPUR, said that such a mandate would end up punishing workers who share crowded homes with roommates and family members, especially in an exorbitantly expensive housing market with scant inventory. He also questioned the

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emphasis on telecommuting rather than on non-polluting modes of transport, and warned of impacts on businesses and government coffers that rely on daily infusions of workers.

"Why require someone who walks to work to stay home?" he said. "What's the congestion benefit of that? What's the economic benefit?"

Gina Papan, a commissioner and council member in the South Bay city of Milbrae, called the mandate "problematic."

"I get the point — greenhouse gas reductions — but I can't support this the way it's currently written," she said.

Fellow commissioner Eddie Ahn, who is the executive director for the environmental justice nonprofit Brightline Defense, echoed those concerns. He and Josefowitz suggested eliminating the strategy or adding language that allows for flexibility by local governments that might eventually need to comply, such as requiring 60% of office workers to telecommute or to take "sustainable trips" to work instead.

Others were more enthusiastic. Oakland Mayor Libby Schaaf said that the pandemic's disruptions to normal life provide an opening for transformational responses to climate change. She called the telecommute mandate "an important policy" whose time has come during Covid-19. "We have to look for silver linings amidst this horrific tragedy, and one of them is that there are opportunities to do things that could not have been done in the past," she said. "Now is the time we can do this in a way that is least disruptive to business."

The 2050 blueprint also maps out a number of major investments that would transform life in the region over the next three decades, such as \$430 billion to maintain and upgrade roads and highways, \$120 billion in transit improvements, nearly \$500 billion for affordable housing, and \$10 billion for expanded high-speed internet. It calls for a number of legislative and policy changes, including a statewide universal basic income and more jobs and housing near transit.

But while the document is intended to guide plans and government funds for the nine counties and 101 cities that comprise the Bay Area, its various prongs are unenforceable in the absence of supporting legislation. The plan also does not detail how governments would require employers to meet the remote work threshold. Therese McMillan, the commission's executive director, said that the amendments suggested by Ahn and Josefowitz, which Schaaf and a number of commissioners



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also supported, could be added in over time, if and when the strategy is enacted as policy. Enforcement is just one of many legal and logistical obstacles facing any effort to impose a telecommuting target for a whole city, from employers who might object due to productivity concerns to businesses that depend on commuting consumers.

Still, a government-backed work-from-home policy at this scale would be a first for U.S. climate policy, and the mandate's appearance on this planning document is a landmark in a year of upheaval in the realm of transportation — and in the wake of a summer of environmental catastrophe in California. Like many cities that took advantage of the pandemic's empty streets to introduce bike lanes, pedestrian corridors, and sidewalk dining options, the MTC is now hoping to cement significant congestion relief for the long haul.

With transportation now the leading source of carbon emissions in the U.S. — and gas-burning personal vehicles topping the list of emitters — getting millions of drivers off the highway would seem like an unambiguous environmental win. But transportation experts echoed commissioners' warnings that continued mass remote work could have unintended consequences. Research shows that telecommuting can bring modest reductions to personal emissions, yet some studies have indicated that increases in home energy use and daytime trips can cancel out some of those savings. Permanent work-from-home lifestyles might also lure employees to live in more suburban and rural areas where transit, walking and biking are less viable, as seen in the "tech exodus" out of San Francisco to spots like Lake Tahoe, Palm Springs and beyond.

"Telecommuting is a viable strategy, but it's a stopgap," said Ethan Elkind, the director of law at the University of California, Berkeley's Center for Law, Energy and the Environment. It can also be used to dodge more aggressive and challenging climate pursuits, he said: For example, when California passed a landmark law in 2008 requiring urban areas to develop compact growth plans lowering carbon emissions, San Diego leaned heavily on telecommuting rather than the types of transit investments and high-density construction the bill was supposed to inspire. While telecommuting may be more politically palatable in the Bay Area, Elkind believes policies such as road pricing and building housing near transit would go further to cut congestion and emissions.

Those ideas are mentioned in the 2050 blueprint. But the MTC has shown little appetite to date for the difficult political fights that would be required to turn them into reality, Elkind said. The same could be said of Governor

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Gavin Newsom, who announced his own radical-sounding climate-saving measure this week: an executive order to end the sale of gas-powered cars in California by 2035. While such a directive promises dramatic progress towards the state's emissions goals, Elkind pointed out that the governor did not support SB 50, a highly contentious state bill that would have required most California communities to increase the amount of housing allowed near transit. It failed to pass earlier this year.

"So far, the governor and the MTC haven't wanted to use their positions of power to take on the upper-income communities that are most resistant to those changes," he said. "Moving to zero-emissions vehicles and telecommuting is really important, but really reducing our per-capita miles has to be done with land use."

Bob Allen, the policy director at Bay Area Urban Habitat, an environmental justice nonprofit, registered another worry: that public transit may be similarly ignored as the region faces the future. Bus and rail agencies in the Bay Area, as throughout the U.S., are weighing drastic service cuts in the face of budget holes created by the pandemic's gutted ridership. While the blueprint calls for transit funding, its approval came hours after another MTC meeting that featured public callers excoriating commissioners for failing to act aggressively to redirect existing transportation funds towards those operators, which serve thousands of low-income residents and essential workers. Allen called for more investment in transit, and less for road construction.

"We're trying to lead the country on climate planning and hit these mandated targets," he said. "I support big shifts in telecommuting, but if it doesn't move the needle, then we're just dancing around the plans."

bloomberg.com, 26 September 2020

<https://www.bloomberg.com>

### **BASF invests 16 Mn euro in Pyrum to support pyrolysis of waste tires**

2020-09-23

**BASF** will invest €16 million into Pyrum Innovations AG, a technology company specialized in the pyrolysis of waste tires, headquartered in Dillingen/Saar, Germany. With the investment, BASF will support the expansion of Pyrum's pyrolysis plant in Dillingen and the further roll out of the technology.

Converting Pyrolysis Oil into Chemical Products

**Pyrum is currently running a pyrolysis plant for end-of-life tires that can process up to 10,000 tons of tires per year.**



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Pyrum is currently running a pyrolysis plant for end-of-life tires that can process up to 10,000 tons of tires per year. Until the end of 2022, two additional production lines will be added to the existing plant. BASF will uptake most of the pyrolysis oil and process it into new chemical products by using a mass balance approach as part of its ChemCycling™ project. The resulting products will mainly be for customers from the plastics industry who are looking for high-quality and functional plastics based on recycled materials.

Furthermore, Pyrum intends to build additional tire pyrolysis plants together with interested partners. The collaborative set-up will accelerate the path towards the use of Pyrum's unique technology in serial production. Future investors in the technology can have the certainty that the pyrolysis oil produced will be taken up by BASF to produce high-performance chemical products.

### Co-operation to Close the Loop for Post-consumer Plastic Waste

The co-operation will thus serve to close the loop for post-consumer plastic waste. Waste tires fall within the definition of post-consumer plastic waste according to DIN EN ISO 14021:2016-07.

BASF and Pyrum anticipate that production capacities of up to 100,000 tons of pyrolysis oil derived from waste tires could be built up within the next years together with additional partners.

*"BASF is committed to leading the transition of the plastics industry to a circular economy. Replacing fossil feedstock through recycled feedstock at the beginning of the chemical value chain is a major lever in this regard. With the investment, we have taken another significant step towards establishing a broad supply base for pyrolysis oil and towards offering our customers products based on **chemically recycled plastic waste** on a commercial scale,"* says Hartwig Michels, president of BASF's Petrochemicals division.

*"After twelve years of hard work Pyrum is proud to finally be accepted by the market. We are confident that we will become one of the market leaders in tire recycling with BASF's investment. We can finally increase our tire recycling and oil production capacity and concentrate our efforts on making our technology even more performant,"* says Pascal Klein, founder and CEO of Pyrum.

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BASF will use the pyrolysis oil from end-of-life tires as an additional raw material source next to oil from mixed plastic waste, the use of which is the long-term focus of the ChemCycling project.

### Products Made from Pyrolysis Offers Lower Carbon Footprint

Products made from pyrolysis oil by using a mass balance approach have the exact same properties as products manufactured with primary fossil resources. In addition, they have a lower carbon footprint than conventional products. This is the conclusion of a Life Cycle Assessment (LCA) analysis, carried out by the consulting company Sphera on behalf of BASF.

Among others, the LCA analysis could show this for the production of polyamide 6 (PA6), a plastics polymer which is, for example, used in the production of high-performance components for the automotive industry. One ton of PA6 produced with tire pyrolysis oil from Pyrum under a mass balance approach emits 1.3 tons less CO<sub>2</sub> compared with one ton PA6 produced with fossil feedstock. The lower emissions result from avoiding the incineration of the end-of-life tires.

[polymer-additives.specialchem.com](https://www.polymer-additives.specialchem.com), 23 September 2020

<https://www.polymer-additives.specialchem.com>

### Could the Sahara ever be green again?

2020-09-29

Sometime between 11,000 and 5,000 years ago, after the last ice age ended, the Sahara Desert transformed. Green vegetation grew atop the sandy dunes and increased rainfall turned arid caverns into lakes. About 3.5 million square miles (9 million square kilometers) of Northern Africa turned green, drawing in animals such as hippos, antelopes, elephants and aurochs (wild ancestors of domesticated cattle), who feasted on its thriving grasses and shrubs. This lush paradise is long gone, but could it ever return?

In short, the answer is yes. The Green Sahara, also known as the African Humid Period, was caused by the Earth's constantly changing orbital rotation around its axis, a pattern that repeats itself every 23,000 years, according to Kathleen Johnson, an associate professor of Earth systems at the University of California Irvine.

**This lush paradise is long gone, but could it ever return?**



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However, because of a wildcard — human-caused [greenhouse gas emissions](#) that have led to runaway [climate change](#) — it's unclear when the Sahara, currently the world's largest hot desert, will turn a new green leaf.

The Sahara's green shift happened because Earth's tilt changed. About 8,000 years ago, the tilt began moving from about 24.1 degrees to the current day 23.5 degrees, [Space.com](#), a Live Science sister site, [previously reported](#). That tilt variation made a big difference; right now, the Northern Hemisphere is closest to the sun during the winter months. (This may sound counterintuitive, but because of the current tilt, the Northern Hemisphere is tilted away from the sun during the winter season.) During the Green Sahara, however, the Northern Hemisphere was closest to the sun during the summer.

This led to an increase in solar radiation (in other words, heat) in Earth's Northern Hemisphere during the summer months. The rise in solar radiation amplified the African [monsoon](#), a seasonal wind shift over the region caused by temperature differences between the land and ocean. The increased heat over the Sahara created a low pressure system that ushered moisture from the Atlantic Ocean into the barren desert. (Usually, the wind blows from dry land toward the Atlantic, spreading dust that fertilizes the Amazon rainforest and builds beaches in the Caribbean, [Live Science previously reported](#).)

This increased moisture transformed the formerly sandy Sahara into a grass and shrub-covered steppe, [according to the National Oceanic and Atmospheric Administration](#) (NOAA). As animals there prospered, humans did too, eventually domesticating buffalo and goats and even creating an early system of symbolic art in the region, NOAA reported.

Image 1 of 6

**Wobbling Earth**

But why did Earth's tilt change in the first place? To understand this monumental change, scientists have looked to Earth's neighbors in the solar system.

"The Earth's axial rotation is perturbed by gravitational interactions with the moon and the more massive planets that together induce periodic changes in the Earth's orbit," Peter de Menocal, the director at the Center for Climate and Life at Lamont-Doherty Earth Observatory at Columbia

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University in New York, [wrote in Nature](#). One such change is a "wobble" in the Earth's axis, he wrote.

That wobble is what positions the Northern Hemisphere closer to the sun in the summer — what researchers call a Northern Hemisphere summer insolation maximum — every 23,000 years. Based on research first published in the journal [Science](#) in 1981, scholars estimate that the Northern Hemisphere had a 7% increase in solar radiation during the Green Sahara compared with now. This increase could have escalated African monsoonal rainfall by 17% to 50%, according to a 1997 study published in the journal [Science](#).

What's interesting to climate scientists about the Green Sahara is how [abruptly](#) it appeared and vanished. The termination of the Green Sahara took only 200 years, Johnson said. The change in solar radiation was gradual, but the landscape changed suddenly. «It's an example of abrupt climate change on a scale humans would notice,» she said.

"Records from ocean sediment show [that the Green Sahara] happens repeatedly," Johnson told Live Science. The next Northern Hemisphere summer insolation maximum — when the Green Sahara could reappear — is projected to happen again about 10,000 years from now in A.D. 12000 or A.D. 13000. But what scientists can't predict is how greenhouse gases will affect this natural climate cycle.

Paleoclimate research "provides unequivocal evidence to what [humans] are doing is pretty unprecedented," Johnson said. Even if humans stop emitting greenhouse gases today, these gases would still be elevated by the year 12000. "Climate change will be superimposed onto the Earth's natural climate cycles," she said.

That said, there's geologic evidence from ocean sediments that these orbitally-paced Green Sahara events occur as far back as the Miocene epoch (23 million to 5 million years ago), including during periods when atmospheric carbon dioxide was similar to, and possibly higher, than today's levels. So, a future Green Sahara event is still highly likely in the distant future. Today's rising greenhouse gases could even have their own greening effect on the Sahara, though not to the degree of the orbital-forced changes, according to a March review published in the journal *One Earth*. But this idea is far from certain, due to climate model limitations.

Meanwhile, there is another way to turn parts of the Sahara into a green landscape; if massive solar and wind farms were installed there, rainfall



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could increase in the Sahara and its southern neighbor, the semiarid Sahel, according to a 2018 study published in the journal [Science](#).

Wind and solar farms can increase heat and humidity in the areas around them, [Live Science](#) previously reported. An increase in precipitation, in turn, could lead vegetation growth, creating a positive feedback loop, the researchers of that study said. However, this huge undertaking has yet to be tested in the Sahara Desert, so until such a project gets funding, humans might have to wait until the year 12000 or longer to see whether the Sahara will turn green again.

*Originally published on Live Science.*

[livescience.com](https://www.livescience.com), 29 September 2020

<https://www.livescience.com>

### Can a genetically modified bug combat a global farm plague?

2020-09-24

A BRITISH BIOTECH firm that developed a genetically modified mosquito to fight dengue fever and other blood-borne diseases in Florida and Texas now has introduced a self-destructing GM caterpillar. Their aim is to stop a pest that is devastating corn and rice crops across the globe.

Executives from the US-owned, but UK-based, firm [Oxitec](#) and its multinational partner Bayer announced today that they have developed a [fall armyworm](#) that has a self-limiting gene introduced into the male of the species. Once the male mates with a female, the resulting egg becomes overloaded with a key protein and quickly dies. "Our gene produces this protein at such high levels that other natural proteins that are important for the caterpillar's development can't be produced," says Neil Morrison, head of agricultural programs at Oxitec. "The normal cell machinery is swamped by the overproduction of this protein." The company's goal is to reduce the population of this kind of worm without pesticides.

Oxitec has already begun small field trials in Brazil of this trademarked "friendly" fall armyworm, according to Morrison, and it hopes to expand the size of the trials there in 2021 upon approval of Brazilian regulators.

Unlike so-called "gene drive" technology, in which a lethal gene is passed on throughout a targeted insect species ad infinitum, Morrison says the protein the Oxitec gene encodes for only affects the female. That

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means the lethal effect will last only a few generations. That built-in obsolescence could help allay concerns that a runaway genetic mutation could potentially destroy an entire species. That's a scenario raised by people who have opposed using such a technology to [eliminate the mosquito species that carries malaria](#).

From its origins in the Americas, the fall armyworm has munched its way around the globe in the past few years, leaving a trail of destruction and ruined crops. After the caterpillar moth landed in West Africa in 2016, it spread quickly throughout 12 nations and caused an estimated \$6.3 billion in damage, according to a [report by the UN's Food and Agriculture Organization](#). An estimated 17.7 million tons of corn crops are eaten by the fall armyworm each year, the report concluded.

Since 2016, the growing infestation of fall armyworms across Africa has forced growers in many developing countries to start spraying pesticides, which normally aren't used by small-scale African farmers and can damage both human health and the environment. In 2017 the Zambian government gave \$3 million to small farmers to fight the fall armyworm with agricultural pesticides, and replanted 222,000 acres of damaged crops. That year in Rwanda, troops were deployed to farmers' fields to crush the insect egg masses by hand, the FAO report stated. From Africa, the armyworm has since invaded 44 countries and found an appetite for more than 80 different crops including rice, sorghum, wheat, and cotton, according to [this report](#) by the UK-based nonprofit Center for Agriculture and Bioscience International.

In North America, the fall armyworm leaves the southern tips of Florida and Texas each spring to spread all the way to Canada, destroying corn, rice, and sorghum fields. It usually doesn't survive winters, according to Ashley Tesselow, an entomology graduate student at Texas A&M University who is researching control measures for the caterpillar. "Sometimes the fall armyworm population size skyrockets, causing an outbreak," Tessnow wrote in an email to WIRED. "When this happens, there are so many fall armyworms that entire fields can be destroyed in just a matter of days if not controlled. These 'Armageddon-like' outbreaks do not occur every year, but they can result in complete yield loss."

Tessnow says it's important to know more about the genetic structure of the fall armyworm, a project she's working on during her doctoral thesis. "It will be interesting to see how effective Oxitec's release of GM fall armyworms is on reducing this insect's population," she writes.



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Oxitec has some experience with producing genetically modified insects. The company began developing a GM mosquito, originally using gene drive technology, back in 2009 to control Zika, a virus passed through mosquito bites, which can cause birth defects in children developing in utero. Oxitec researchers then developed a second-generation mosquito with the self-limiting lethal gene that would only last for a few generations. That mosquito was approved by the Environmental Protection Agency for release this year in the Florida Keys, despite opposition from some environmental groups and local residents, who argued that the agency hadn't fully considered the effects on human health and the environment.

After its approval by EPA regulators, Oxitec CEO Grey Frandsen said that using the GM mosquito would be both safer and cheaper than spraying chemicals to kill immature mosquitoes that can transmit dengue fever, Zika, and other blood-borne diseases. "Our aim is to empower governments and communities of all sizes to effectively and sustainably control these disease-spreading mosquitoes without harmful impact on the environment and without complex, costly operations," Frandsen stated in a press release issued in May. "The potential for our technology to do so is unmatched, and this EPA approval will allow us to take the first steps towards making it available in the US."

Oxitec also developed a genetically modified diamondback moth and did field trials in upstate New York in 2017 that used similar self-limiting genetic modification technology to reduce the population of a caterpillar that eats cruciferous crops like cabbage, cauliflower, and broccoli. That project was completed, and showed promising results, but the company decided to switch to the fall armyworm, Morrison says.

Still, not everyone believes introducing a modified insect is the way to combat agricultural pests. One skeptic is Jaydee Hanson, policy director at the Center for Food Safety, a Washington-based advocacy group that previously opposed the EPA's decision to release Oxitec's modified mosquito. After all, Hanson says, the Oxitec program would only kill one of many insects faced by farmers in the developing world, leaving the others to move in. "The problem is when you take a .22 rifle approach and what you need is something that will kill off, in a sustainable way, the other pests," he says.

Anthony Shelton, a professor of entomology at Cornell University, worked with Oxitec on the experimental release of the diamondback moth in 2017. He agrees that the battle between farmers and pests can resemble

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an endless treadmill of technological innovation by scientists, immediately countered by fast-breeding insects who evolve to avoid what science throws at them, such as by developing resistance to pesticides. "We constantly have to modify our strategies, because it's a biological system," Shelton says. "What we need to do is find strategies that are more durable and more environmentally friendly."

Both Shelton and Tessnow say that any genetically modified organism must be part of a system called integrated pest management, which includes rotating crops to stymie any buildup of insects on one particular plant, encouraging the growth of the pest's natural predators, and using limited amounts of pesticides so insects that survive the chemicals don't get a chance to build up resistance to them.

There's a lot riding on the potential success of a chemical-free solution to the fall armyworm explosion that has shuttered farms across the world's tropical zones. "This is a really serious global pest," Shelton says. "We need to look at all the technologies to figure out what will work so we don't have this catastrophe in agriculture."

wired.com, 24 September 2020

<https://www.wired.com>

### Daily black licorice habit kills Massachusetts construction worker

2020-09-24

A Massachusetts construction worker's love of black licorice wound up costing him his life. Eating a bag and a half every day for a few weeks threw his nutrients out of whack and caused the 54-year-old man's heart to stop, doctors reported Wednesday.

"Even a small amount of licorice you eat can increase your blood pressure a little bit," said Dr. Neel Butala, a cardiologist at Massachusetts General Hospital who described the case in the *New England Journal of Medicine*.

The problem is glycyrrhizic acid, found in black licorice and in many other foods and dietary supplements containing licorice root extract. It can cause dangerously low potassium and imbalances in other minerals called electrolytes.

Eating as little as 2 ounces of black licorice a day for two weeks could cause a heart rhythm problem, especially for folks over 40, the U.S. Food and Drug Administration warns.

**The man had switched from red, fruit-flavored twists to the black licorice version of the candy a few weeks before his death last year.**



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"It's more than licorice sticks. It could be jelly beans, licorice teas, a lot of things over the counter. Even some beers, like Belgian beers, have this compound in it," as do some chewing tobaccos, said Dr. Robert Eckel, a University of Colorado cardiologist and former American Heart Association president. He had no role in the Massachusetts man's care.

The death was clearly an extreme case. The man had switched from red, fruit-flavored twists to the black licorice version of the candy a few weeks before his death last year. He collapsed while having lunch at a fast-food restaurant. Doctors found he had dangerously low potassium, which led to heart rhythm and other problems. Emergency responders did CPR and he revived but died the next day.

The FDA permits up to 3.1 percent of a food's content to have glycyrrhizic acid, but many candies and other licorice products don't reveal how much of it is contained per ounce, Butala said. Doctors have reported the case to the FDA in hope of raising attention to the risk.

Jeff Beckman, a spokesman for the Hershey Company, which makes the popular Twizzlers licorice twists, said in an email that "all of our products are safe to eat and formulated in full compliance with FDA regulations," and that all foods, including candy, "should be enjoyed in moderation."

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[nbcnews.com](https://www.nbcnews.com), 24 September 2020

<https://www.nbcnews.com>

### What tear gas does to fish

2020-09-23

Juniper Simonis was radicalized on July 10, 2020, in Portland, Oregon. That's the date, Simonis says, that—while they were chalking the property line of a federal building to show protesters where to stand—unidentified federal agents grabbed them and their service dog, Wallace, and held them for nine hours without food, water, or access to a phone.

Simonis, an ecologist and lead scientist at Dapper Stats, a data analysis firm for field scientists, has been a long-time supporter of the Black Lives Matter movement. They had been taking part in protests and demonstrations in Portland this summer, enduring a barrage of tear gas, pepper spray, and flash bang grenades from police and federal agents.

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Being detained galvanized them to start looking for other ways to get involved in the movement—ways that would put their specific skills to use. It was when Simonis saw the residues from chemical munitions being hosed off the streets and into storm drains that they were struck with an idea.

"I thought, Oh fuck, those are storm drains that go right to the Willamette River," Simonis says. "How is that affecting the ecosystem?"

Since many scientists are focusing on the human health effects of these munitions, Simonis thought that studying their environmental and ecological effects would be the best way to help.

"It's kind of ridiculous that this is what's bringing me back into the field," they say.

Though protests this year against racial injustice have spanned the United States (and the world), Portland, a city with a pronounced racist history, has been one of the epicenters. By the end of July, local police and federal law enforcement agencies had used tear gas and other riot control agents almost every day for two straight months, and the residues were often washed down storm drains. But little is known about the fate and ecological effects of the chemicals in these munitions, says Katherine von Stackelberg, an environmental health scientist at Harvard University in Massachusetts.

Tear gas, also known as CS gas, is a complicated compound. It has different chemical constituents depending on the manufacturer, but the main ingredient is 2-chlorobenzalmalononitrile. The one known study on the effects of CS on aquatic organisms, von Stackelberg says, found that concentrations as low as 0.2 to 0.3 milligrams per liter could kill rainbow trout. That's an extremely low concentration, von Stackelberg says. The other potential toxicants in CS tend to only have effects at around 1,000 milligrams per liter.

"There is not a lot of data on it, but we know the primary constituent found in most tear gas will be acutely toxic to aquatic organisms," she says. "Whether the Willamette River is at risk, I don't think we can go that far, but the potential for it is certainly there."

Then there are the degradation products: the compounds that result from the main chemicals in the munitions breaking down. And a canister of tear gas will also hold a whole stew of accelerants and aerosolizing agents. Other chemical munitions that are being used, such as hexachloroethane



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smoke bombs, which contain zinc, present different threats. With the chemical munitions being used night after night for months, there is also a potential for longer-term effects, says von Stackelberg.

Simonis is trying to fill in those gaps by digging up exactly what the existing scientific literature has to say, and by conducting controlled toxicity studies in a lab they built in their garage.

"I want to find out what is in each canister, and how it mobilizes and decomposes," Simonis says. They are also collecting evidence that the chemicals are indeed reaching waterways. Simonis has found spent munitions in culverts that empty into the Willamette River—some of them just downstream from a restored salmon-rearing habitat.

The legality of washing the chemical residues of these munitions into storm drains is not in question. [Official safety documentation](#) for CS gas states that it should not be allowed to get into drains or bodies of water, and Oregon state law says that any chemical munition should be treated as hazardous waste and cleaned up appropriately.

Simonis is not the only one concerned with the environmental effects of these munitions. Two lawmakers, Representative Karin Power and Congressman Earl Blumenauer, [wrote to the US Environmental Protection Agency in July](#) calling for an investigation into the environmental and public health impacts of the munitions.

Portland's Bureau of Environmental Services has cleaned out several storm drains in the area where the munitions were used. The bureau could not gain access to one storm drain, however, which was behind an illegally erected barrier around the federal courthouse. The city has [issued a US \\$20,000 fine](#) to the federal government for denying access to the drain, but it is not clear if or when the barrier will be removed. In its samples, the bureau found elevated levels of several contaminants in the storm water and sediments, but determined that the levels had returned to normal before reaching the river.

Nevertheless, Portland mayor Ted Wheeler issued an executive order on September 10 banning the use of tear gas for crowd dispersal in the city, in part because of the risk to the environment.

[hakaimagazine.com](https://www.hakaimagazine.com), 23 September 2020

<https://www.hakaimagazine.com>

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**Coronavirus mutations: what we've learned so far**

2020-09-26

In early January, the first genome sequence of Sars-CoV-2 — the virus that causes COVID-19 — was released under the moniker "Wuhan-1". This string of 30,000 letters (the A, T, C and Gs of the genetic code) marked day one in the race to understand the genetics of this newly discovered coronavirus. Now, a further 100,000 coronavirus genomes sampled from COVID-19 patients in over 100 countries have joined Wuhan-1. Geneticists around the world are mining the data for answers. Where did Sars-CoV-2 come from? When did it start infecting humans? How is the virus mutating — and does it matter? Sars-CoV-2 genomics, much like the virus itself, went big and went global.

The term mutation tends to conjure up images of dangerous new viruses with enhanced abilities sweeping across the planet. And while mutations constantly emerge and sometimes sweep — early mutations in Sars-CoV-2 have made their way around the world as the virus spread almost unnoticed — mutations are a perfectly natural part of any organism, including viruses. The vast majority have no impact on a virus's ability to transmit or cause disease.

A mutation just means a difference; a letter change in the genome. While the Sars-CoV-2 population was genetically essentially invariant when it jumped into its first human host [in late 2019](#), over 13,000 of these changes are now found in the 100,000 Sars-CoV-2 sequenced to date. Yet any two viruses from any two patients anywhere in the world differ on average by only [ten letters](#). This is a tiny fraction of the total 30,000 characters in the virus's genetic code and means that all Sars-CoV-2 in circulation can be considered part of a single clonal lineage.

**PLAY SOUND****Slowly mutating**

It will take some time for the virus to acquire substantial genetic diversity. Sars-CoV-2 mutates fairly slowly for a virus, with any lineage acquiring [a couple of changes every month; two to six-fold lower](#) than the number of mutations acquired by influenza viruses over the same period.

Still, mutations are the bedrock on which natural selection can act. Most commonly mutations will render a virus non-functional or have no effect whatsoever. Yet the potential for mutations to affect transmissibility of Sars-CoV-2 in its new human hosts exists. As a result, there have been

**How is the virus mutating — and does it matter?**



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intense efforts to determine which, if any, of the mutations identifiable since the first Sars-CoV-2 genome was sequenced in Wuhan may significantly alter viral function.

An infamous mutation in this context is an amino acid change in the Sars-CoV-2 spike protein, the protein that gives coronaviruses their characteristic crown-like projections and allows it to attach to host cells. This single character change in the viral genome — termed D614G — has been shown to increase virus infectivity in cells grown in the lab, though with no measurable impact on disease severity. Although this mutation is also near systematically found with three other mutations, and all four are now found in about 80% of sequenced Sars-CoV-2 making it the most frequent set of mutations in circulation.

The challenge with D614G, as with other mutations, is disentangling whether they have risen in frequency because they happened to be present in viruses responsible for seeding early successful outbreaks, or whether they truly confer an advantage to their carriers. While genomics work on a UK dataset suggests a subtle role of D614G in increasing the growth rate of lineages carrying it, our own work could find no measurable impact on transmission.

### Simply carried along

D614G is not the only mutation found at high frequency. A string of three mutations in the protein shell of Sars-CoV-2 are also increasingly appearing in sequencing data and are now found in a third of viruses. A single change at position 57 of the Orf3a protein, a known immunogenic region, occurs in a quarter. Other mutations exist in the spike protein while myriad others seem induced by the activity of our own immune response. At the same time, there remains no consensus that these, or any others, are significantly changing virus transmissibility or virulence. Most mutations are simply carried along as Sars-CoV-2 continues to successfully spread.

But replacements are not the only small edits that may affect Sars-CoV-2. Deletions in the Sars-CoV-2 accessory genes Orf7b/Orf8 have been shown to reduce the virulence of Sars-CoV-2, potentially eliciting milder infections in patients. A similar deletion may have behaved in the same way in Sars-CoV-1, the related coronavirus responsible for the Sars outbreak in 2002-04. Progression towards a less virulent Sars-CoV-2 would be welcome news, though deletions in Orf8 have been present from the early days of the pandemic and do not seem to be increasing in frequency.

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While adaptive changes may yet occur, all the available data at this stage suggests we're facing the same virus since the start of the pandemic. Chris Whitty, chief medical officer for England, was right to pour cold water on the idea that the virus has mutated into something milder than the one that caused the UK to impose a lockdown in March. Possible decreases in symptom severity seen over the summer are probably a result of younger people being infected, containment measures (such as social distancing) and improved treatment rather than changes in the virus itself. However, while Sars-CoV-2 has not significantly changed to date, we continue to expand our tools to track and trace its evolution, ready to keep pace.

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livescience.com, 26 September 2020

<https://www.livescience.com>



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[Toxicity and deleterious effects of Artemisia annua essential oil extracts on mulberry pyralid \(\*Glyphodes pyloalis\*\)](#)

### ENVIRONMENTAL RESEARCH

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### OCCUPATIONAL

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