

# Bulletin Board

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SEP. 11, 2020

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## Regulatory Update

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### ASIA PACIFIC

#### APVMA finishes 2019-20 with continued strong performance

2020-08-31

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has finished 2019–20 with continued strong performance, demonstrating further improvements in the on-time assessment of agricultural and veterinary (agvet) chemical products.

Statistics released for the June quarter 2020 show the APVMA completed 2963 product, active and permit applications in 2019–20, finalising 89 per cent within legislative timeframes, ahead of the 85 per cent recorded in 2018–19.

This included considerable improvement in the on-time assessment of veterinary medicine applications, increasing from 81 per cent in 2018–19 to 89 per cent in 2019–20.

The rate of pesticide applications completed within timeframe also increased, from 85 per cent in 2018–19 to 93 per cent in 2019–20.

APVMA Acting Chief Executive Officer, Ms Lisa Croft, said the authority's continued strong performance throughout 2019–20 reflected the dedication of APVMA staff to improve regulatory performance and streamline risk assessment and decision making processes.

"We've demonstrated another quarter and another year of improved performance, despite the interruption of the COVID-19 pandemic," Ms Croft said.

"The tireless work of APVMA staff has resulted in the on-time approval of numerous products and new uses for existing products, which will support Australia's agricultural productivity, improve animal health, and provide consumers with more options for agvet chemical products that are safe and effective to use."

The APVMA's focus in 2020–21 is to further improve the timeliness of its regulatory decisions, while ensuring the assessment of agvet chemical products continues to meet the highest of scientific quality standards.

View the [June 2020 performance report](#).

**The rate of pesticide applications completed within timeframe also increased, from 85 per cent in 2018–19 to 93 per cent in 2019–20.**

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For more [news and updates](#) from the Australian Pesticides and Veterinary Medicines Authority (APVMA), visit our website.

Australian Pesticides and Veterinary Medicines Authority (APVMA), 31 August 2020

<https://apvma.gov.au>

#### Safe Work Australia has published new guidance to help businesses navigate the transition to GHS 7

2020-08-31

Australia will begin a two-year transition to the Globally Harmonized System of Classification and Labelling of Chemicals Revision 7 (GHS 7) on 1 January 2021.

To help businesses understand the changes under GHS 7, Safe Work Australia has published a dedicated GHS 7 web page and suite of information sheets. These information sheets provide details about classification and labelling requirements for workplace hazardous chemicals, and the duties of manufacturers, importers, suppliers and end users.

Learn more on the new [GHS 7 web page](#).

#### Special arrangements from 1 July 2020 to 1 January 2021

The transition to GHS 7 was due to start on 1 July 2020, however was delayed due to the impact of COVID-19 on Australian businesses.

To ensure that businesses who had started to implement GHS 7 are not disadvantaged, work health and safety (WHS) regulators are allowing importers and manufacturers to classify and label chemicals in accordance with GHS 7 from 1 July 2020 to 1 January 2021, ahead of the official transitional period.

Suppliers and end users can supply and use GHS 3 or GHS 7 labelled chemicals during this period.

Contact your [WHS regulator](#) for more information about the arrangements in your area.

Safe Work Australia, 31 August 2020

<https://www.safeworkaustralia.gov.au/ghs-7-transition>

**The transition to GHS 7 was due to start on 1 July 2020, however was delayed due to the impact of COVID-19 on Australian businesses.**

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## Regulatory Update

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### Public consultation-changes to publication process for submissions

2020-09-02

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is updating our process for handling submissions received in response to [public consultations](#).

For public consultations **starting on or after 2 September 2020**, submissions will be published on our website unless:

- the author requests the submission (or part(s) of it) remain confidential, or
- we determine it would be unreasonable to publish the submission.

We've also introduced a [public submission coversheet](#) to be lodged with submissions, which stakeholders can use to specify any parts of their submission they may not want published.

Once a public consultation has concluded we will publish a summary, and a consolidated copy, of submissions received.

Questions about the APVMA's revised public consultation submission process can be directed to [enquiries@apvma.gov.au](mailto:enquiries@apvma.gov.au).

For more [news and updates](#) from the Australian Pesticides and Veterinary Medicines Authority (APVMA), visit our website.

Australian Pesticides and Veterinary Medicines Authority (APVMA), 2 September 2020

<https://apvma.gov.au>

## AMERICA

### EPA draft regulation on Acrylamide

2020-08-25

The California EPA oversees Prop 65, which passed as a ballot initiative in 1986 to warn residents about contaminants in drinking water. Since that time the regulations have grown to encompass any chemical that could be carcinogenic.

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Affecting food and agriculture, the EPA recently came out with a draft regulation on acrylamide. This is one to pay attention to says Agricultural Council of California President Emily Rooney.

Rooney... "Acrylamide is a byproduct of cooking. It's in roasted/baked products, some juice products, you know, a lot of foods that have been concentrated one way or another. And they've created some safe Harbor levels for acrylamide. So this is very important if you were in the nut industry and the juice industry and breads or other baked goods. Those folks really need to be either reaching out to us at Ag Council to learn more about the regulation or the California Environmental Protection Agency to weigh in on, on whether or not those safe harbor levels work for you. But again, this is dealing with acrylamide and some positive movement in this regulation, as it relates to Prop 65."

There is an open public comment period happening right now until the first part of October. Make sure to reach out to inquire how this acrylamide regulation might impact your industry.

AGInfo, 25 August 2020

<https://www.aginfo.net/report/46958/California-Ag-Today/EPA-Draft-Regulation-on-Acrylamide>

### EPA proposes to extend ICR regarding TSCA Section 8(a) reporting and recordkeeping requirements for certain nanoscale materials

2020-08-27

The U.S. Environmental Protection Agency (EPA) announced on August 27, 2020, that it submitted an information collection request (ICR), "Chemical-Specific Rules under the Toxic Substances Control Act Section 8(a); Certain Nanoscale Materials" to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act (PRA). 85 Fed. Reg.... [Continue Reading](#)

Nano and Other Emerging Chemical Technologies Blog, 27 August 2020

<https://nanotech.lawbc.com/>

**Once a public consultation has concluded we will publish a summary, and a consolidated copy, of submissions received.**

**Environmental Protection Agency (EPA) announced on August 27, 2020, that it submitted an information collection request (ICR), "Chemical-Specific Rules under the Toxic Substances Control Act Section 8(a); Certain Nanoscale Materials" to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act (PRA).**

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### Shape up or ship out: California requires ships, trucks to eliminate thousands of tons of pollution

2020-08-27

Ships and trucks will be required to cut thousands of tons of air pollution in communities near ports, freeways and warehouses under a pair of rules unanimously adopted by the Air Resources Board today.

The rules overhaul regulations for diesel truck exhaust and expand emission reductions from ships idling in California's ports. The two rules, when fully implemented, are expected to eliminate some 10,000 tons of pollution per year, the state's biggest strike against smog in twelve years.

[Full Article](#)

Cal Matters, 27 August 2020

<https://calmatters.org/environment/2020/08/california-ships-trucks-pollution-ports/>

## EUROPE

### France issues new order on food contact rubber and pacifiers for young children

2020-08-25

France has published a new Order on rubber materials and articles intended to come into contact with foodstuffs and pacifiers for infants and young children. This new legislation will become effective on July 1, 2021.

On August 11, 2020, France published Order of August 5, 2020 to regulate food contact rubber materials and articles, as well as pacifiers for young children ('new Order'). This new Order replaces and repeals the Order of November 9, 1994 (consolidated version to June 2020 for reference) relating to rubber materials and articles in contact with foodstuffs, food products and drinks.

The new law contains, several important changes. It:

- Clarifies the definition of rubber covers and vulcanized thermoplastic elastomers, but not silicone elastomers
- Updates the lists of authorized substances for the manufacture of rubber materials and articles intended to come into contact with food and pacifiers for infants and young children

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- Updates the restrictions and specifications for these authorized substances due to new scientific information, including specific migration limits (SMLs)
- Updates certain rules for verifying the conformity of rubber materials and articles
- Adds a completely new requirement for declaration of compliance (Doc)
- Expresses overall migration limits (OMLs) and their requirements in one of two specifications:
- $\leq 10 \text{ mg/dm}^2$  for 1) all articles 2) pacifiers for infants and young children and 3) gaskets, valves and valve elements where the ratio between the surface in contact with food and the volume is not known or specified
- $\leq 60 \text{ mg/kg}$  for 1) food contact materials and articles for infants and young children 2) bottle nipples (teats) and 3) gaskets, valves and valve elements where the ratio between the surface in contact with food and the volume is known or specified

The new Order will become effective on July 1, 2021.

[Full Article](#)

Safeguards, 25 August 2020

<https://www.sgs.com/en/news/2020/08/safeguards-12820-france-issues-new-order-on-food-contact-rubber-and-pacifiers-for-young-children#:~:text=France%20has%20published%20a%20new,effective%20on%20July%201%2C%202021>

## INTERNATIONAL

### From protecting pollinating insects to cutting the hoofprint of cashmere-producing goats, companies are aiming greener

2020-08-25

From helping Mongolia's goat herders produce cashmere more efficiently to counting insects on "biodiversity plots" planted on farms, some of the world's biggest brands are blazing a trail with innovative efforts to nurture nature.

Sustainability researchers say businesses have shown a surge of interest in limiting the harm their operations do to the planet, as scientists have

**At least 400 firms have signed up to international commitments to protect nature, and more than 1,200 companies already are taking some steps in their operations, she added.**

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outlined more clearly the threats to forests, water, soil, plants, animals, birds - and people.

“For decades we have been trying to get companies on board with this journey but in the past six to 12 months, I have never seen so much interest,” said Eva Zabey, executive director of **Business for Nature**, a coalition lobbying for stronger government policies and more corporate action.

At least 400 firms have signed up to international commitments to protect nature, and more than 1,200 companies already are taking some steps in their operations, she added.

Britain on Monday said it would start a consultation process on a potential new law that would force big companies to clean up their supply chains by fining them if they used products grown on illegally deforested land.

A **World Economic Forum report** in January estimated that \$44 trillion of economic value generated around the world each year - over half of global GDP - depends on nature and its services.

Those include food crop pollination, genetic material for medicines and mangroves to reduce storm damage, said Cath Tayleur, a senior programme manager for business and nature at the **Cambridge Institute for Sustainability Leadership** (CISL).

“The key message is that your business can’t continue to have negative impacts while still expecting to benefit from the positive aspects of biodiversity,” she told a webinar on business and nature this month.

### Full Article

Thomson Reuters Foundation News, 25 August 2020

<https://news.trust.org/item/20200825085807-3x8ky/>

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## REACH Update

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### **EUON publishes nanopinion on nanosilver in healthcare**

2020-09-01

On August 31, 2020, the European Union (EU) Observatory for Nanomaterials (EUON) published a Nanopinion entitled “Nanosilver in healthcare — does the silver bullet exist?” by Dr. Dorota Napierska, Chemicals Policy and Projects Officer, Health Care Without Harm Europe (HCWH Europe).

### Full Article

Nano and Other Emerging Chemical Technologies Blog, 1 September 2020

<https://nanotech.lawbc.com/2020/09/euon-publishes-nanopinion-on-nanosilver-in-healthcare>

### **Sharing information on exports of harmful chemicals continues to grow**

2020-08-31

ECHA/PR/20/06

Notifications from EU companies to export certain hazardous chemicals outside the Union have continued to steadily rise over the last three years. More than 10 000 notifications were processed in 2019 – an increase of around 35 % compared to 2016. With the increased workload, adequate resourcing is a necessity for future PIC work.

Helsinki, 31 August 2020 – ECHA’s second report on the operation of the Prior Informed Consent (PIC) Regulation shows that the regulatory actions taken in the EU to severely restrict the use of several hazardous chemicals has expanded the export notification obligations and resulted in a record number of 10 703 notifications being processed in 2019.

The workload of the Agency has consequently continued to increase during the three-year period from 2017-19. In addition to the processing of the export notifications, in 2019, the number of requests for support from EU and non-EU designated national authorities has grown by 72 % and the number of helpdesk questions from exporting and importing countries by 25 % compared to those in 2016.

ECHA has produced several guidelines to help EU companies understand their obligations under PIC. The Agency has also continued to support the European Commission on Rotterdam Convention activities – helping with substance identification activities, preparing 30 notifications of final

**On August 31, 2020, the European Union (EU) Observatory for Nanomaterials (EUON) published a Nanopinion entitled “Nanosilver in healthcare — does the silver bullet exist?” by Dr.**

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regulatory actions taken in the EU to severely restrict the use of chemicals, and taking part in various communication and capacity-building projects.

The amount of staffing and budget available for PIC activities has, however, not increased proportionally, with the Agency needing to manage the higher workload with similar resources.

*Bjorn Hansen*, ECHA's Executive Director says: "Despite all of our achievements, the continued increase in our workload is a concern. It is crucial that we have adequate staffing and enough budget in place to carry out our tasks and ensure that international trade of very hazardous chemicals remains informed and transparent, and that the environment and the health of those outside of the EU's borders is also protected."

### Full Article

ECHA, 31 August 2020

<https://echa.europa.eu/-/sharing-of-information-on-exports-of-harmful-chemicals-continues-to-grow>

### **Tetraglyme proposed as candidate for regulation in EU – ECHA says plan to restrict dechlorane plus flame retardant expected in April**

2020-09-03

Aglycol ether sometimes called tetraglyme would become a candidate for tight regulation in the European Union under a proposal pending at the European Chemicals Agency (ECHA).

The substance, tetraethylene glycol dimethyl ether, is used as a solvent or extraction agent in inks and toners, ECHA says.

A proposal from Austria would deem the compound a "substance of very high concern" because it is toxic to reproduction. After a public comment period on the proposal, ECHA will decide whether the chemical qualifies for this categorization and thus become a candidate for strict regulation under the EU Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) law.

In a move toward EU regulation of another compound, Norway intends to propose restricting the manufacture, use, and sales of the polychlorinated flame retardant known as dechlorane plus, ECHA says. In 2018, ECHA classified dechlorane plus, which is used in polymers, as a substance of very high concern because it is persistent and bioaccumulative.

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Norway's formal regulatory proposal is expected in April 2021.

Meanwhile, governments are considering restrictions on dechlorane plus under an international treaty, the Stockholm Convention on Persistent Organic Pollutants. The substance has been found widespread in the environment.

### Full Article

Chemical & Engineering News, 3 September 2020

<https://cen.acs.org/policy/chemical-regulation/Tetraglyme-proposed-candidate-regulation-EU/98/web/2020/09>

**In 2018, ECHA classified dechlorane plus, which is used in polymers, as a substance of very high concern because it is persistent and bioaccumulative.**

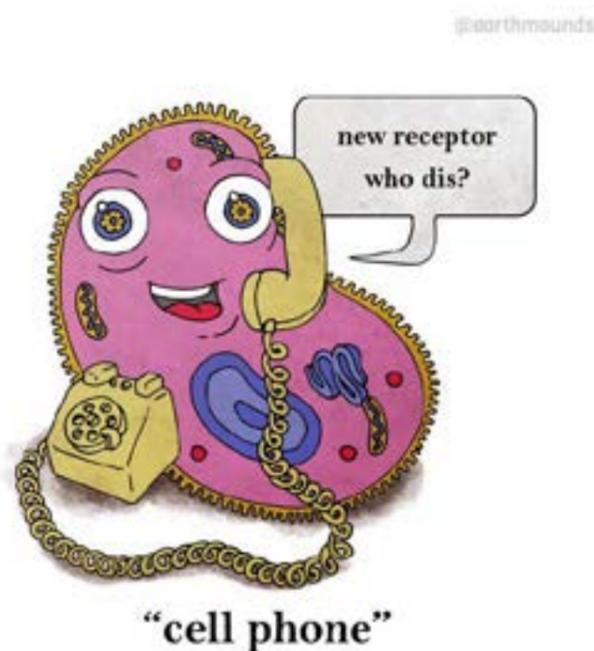
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## Janet's Corner

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### Cell Phone

2020-09-11



<https://www.pinterest.com.au/pin/831617887414870329/>

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## Hazard Alert

SEP. 11, 2020

### Isopropyl Alcohol

2020-09-11

Isopropyl alcohol (aka isopropanol) is a colourless, combustible liquid with a strong odour. Its chemical formula is  $\text{CH}_3\text{CHOHCH}_3$ . Isopropyl alcohol is a volatile liquid, and if left exposed to the elements, it will evaporate quickly. [1,2,3]

#### USES [1,3]

Isopropyl alcohol is used across a range of applications. It is primarily used as a solvent and in the medical industry as a cleaning agent. As a solvent it is used in many home cleaning products, as its ability to evaporate quickly means there is little chance of shock or damage to electrical components. In the medical industry, isopropyl alcohol is commonly used as an ingredient in rubbing alcohol, with distilled water. It is also used in disinfecting pads. In addition, isopropyl alcohol is used as an ingredient in a range of products, including make soaps, window cleaners, antifreezes, perfumes and more.

#### ROUTES OF EXPOSURE [1]

- Pure isopropyl alcohol is readily absorbed through the skin.
- Home-use products with isopropyl alcohol in them usually have approximately 70% of the compound in them, so they are less toxic than industry-standard versions. However, there is still a chance of toxic exposure.

#### HEALTH EFFECTS

Isopropyl alcohol poisoning affects a range of systems, including the nervous and respiratory systems.

#### Acute Effects [1,5]

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

Acute exposure to the chemical compound can result in headaches, vomiting, dizziness, nausea, unconsciousness, comas, and death. Exposure can also cause CNS depression, low arterial pressure, abdominal pain, slowing respiration and coughing.

**Isopropyl alcohol (aka isopropanol) is a colourless, combustible liquid with a strong odour.**

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### Chronic Effects [1,5]

Chronic exposure to isopropyl alcohol is toxic to multiple body systems. Long term exposure to the chemical compound can cause cracking, red, itchy and dry skin; impaired memory and inflammation of the skin. There is not a glut of information regarding long term exposure to isopropyl alcohol specifically, but generally, chronic exposure to solvents is known to increase the risk of kidney and liver dysfunction.

### SAFETY

#### First Aid Measures [5]

- Ingestion: DO NOT INDUCED VOMITING. Rinse victim's mouth with water. Get immediate medical attention.
- 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 water. If symptoms persist, contact a doctor immediately.
- Eye contact: Flush eyes (including under the eyelids), with water for at least 15 minutes. Contact a medical professional.
- Inhalation: Take victim to the nearest fresh air source and monitor their breathing. Keep the victim warm. If the victim is not breathing, and you are qualified, you may perform CPR with a one-way valve or protective mask. Immediately contact a medical professional.
- 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 acid in the air.
- Personal protection: Safety glasses, protective and dustproof clothing, gloves, an apron and an appropriate mask or dusk respirator. Wear impervious shoes. Do not wear contact lenses. For specifications regarding other PPE, Follow the guidelines set in your jurisdiction.

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## Hazard Alert

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### REGULATION [6]

#### United States:

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average (TWA) concentration limit for isopropyl alcohol of 400ppm.

#### Australia [5]

An 8-hour TWA for isopropyl alcohol of 400ppm has been set.

### REFERENCES

1. <https://www.wisegeek.com/what-is-isopropyl-alcohol.htm#>
2. [https://en.wikipedia.org/wiki/Isopropyl\\_alcohol](https://en.wikipedia.org/wiki/Isopropyl_alcohol)
3. <https://study.com/academy/lesson/what-is-isopropyl-alcohol-uses-structure-formula.html>
4. <https://pubchem.ncbi.nlm.nih.gov/compound/Isopropyl-alcohol>
5. [https://www.sceneys.com.au/media/pdfs/msds/Isopropyl\\_Alcohol\\_SDS.PDF](https://www.sceneys.com.au/media/pdfs/msds/Isopropyl_Alcohol_SDS.PDF)
6. <https://www.osha.gov/dsg/annotated-pels/tablez-1.html>

## Bulletin Board

## Gossip

SEP. 11, 2020

**What COVID-19 means for coastal cleanups**

2020-08-31

In an ordinary year, Californians gather along the state's beaches, parks, and waterways on the third Saturday of September to pick up trash before it can make its way into the Pacific. Every cigarette butt, bottle cap, and plastic bag in sight is collected and recorded, each a new point in a massive data set built over 35 years of coastal cleanups. Now, both the ecosystem and the data describing it are at risk.

Last year, more than 74,000 volunteers showed up to Coastal Cleanup Day, an event organized by the California Coastal Commission and its partners throughout the state. They picked up hundreds of thousands of kilograms of trash in a matter of hours.

In late May, however, as COVID-19 cases surged in California following the state's first attempt to reopen, Eben Schwartz, the commission's marine debris program manager, and his colleagues realized that any large gathering, even outdoors, would be too risky come September. Rather than cancel the event, the California Coastal Commission decided to transform it. They're now encouraging Californians to go out into their own neighborhoods every Saturday in September. "We're trying to salvage it as best we can," says Schwartz.

He's optimistic that volunteers will still go out on their own, but less sure about what that means for the cleanup's itemized data set. Historically, that record has helped guide policymakers in creating targeted regulations—like the plastic bag bans imposed across the state over the past 13 years—and tracking their success.

"We can see the impact of our plastic bag bans," Schwartz says. "We've seen the numbers dropping steadily in our cleanup data over the last 10 years." But California is one of many states that lifted such bans this spring amid the confusion around the emerging virus and lobbying from the plastics industry suggesting—falsely—that plastic is less likely to transmit the virus than other materials.

This year's data could be critical for assessing the consequences of that backslide, and for providing empirical support for anecdotal reports that masks, gloves, and other COVID-19-related trash are piling up in remote marine ecosystems.

**They picked up hundreds of thousands of kilograms of trash in a matter of hours.**

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Schwartz wonders if the pandemic will lead to an uptick in personal protective equipment or plastic bag pollution. "I really want that data, and it's going to be hard to gather it in the same way that we've been doing."

I Love A Clean San Diego, one of the commission's partner organizations for Coastal Cleanup Day, has already experimented with hosting more localized neighborhood cleanups.

The nonprofit normally organizes two large cleanups every year—Creek to Bay in April, and Coastal Cleanup Day in September—which both attract between 5,000 and 6,000 volunteers locally. This year the organization pushed the Creek to Bay event back to mid-June, and discouraged volunteers from gathering in large groups during the cleanup. Only about half the usual number of people registered for the event this year, according to Ian Monahan, the philanthropy and marketing manager for the organization.

There were other key differences that might hurt the quality of the data. "Under normal circumstances, we physically weigh and sort the trash," he says, "so we don't necessarily rely on the individual to report."

The issue is not unique to California cleanups. "All the data is going to have an asterisk next to it for this year," Monahan says.

This year, the California Coastal Commission is encouraging volunteers to use the Clean Swell App to record itemized trash data—a platform developed by Ocean Conservancy, the nonprofit that has spearheaded the international coastal cleanup event for the last 34 years.

Ocean Conservancy has made key changes to the app, including adding gloves and masks to the debris list and incorporating a function that allows volunteers to record trash by total weight, rather than per item.

"While we're apprehensive about the item data, we're optimistic that people will feel empowered to go out there and pick this stuff up," says Allison Schutes, the director of the International Coastal Cleanup. "There's a pre-COVID and a post-COVID, and our approach is very different now."

It may be difficult to fully quantify the direct and indirect impacts of COVID-19 on coastal plastic pollution. But I Love A Clean San Diego has already gleaned some insights from the data that came out of the Creek to Bay event. Cigarette butts and plastic pieces still topped the list, Monahan says, but there was a noticeable increase in disposable masks and plastic bags. "Those flimsy, tumbleweed plastic bags came roaring back," he says.

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Ultimately, a year or two of wonky data is less important than what we do with the mountain of data that already exists showing that single-use plastics are the major source of marine pollution, says Miriam Gordon, the policy director for Upstream, a nonprofit focused on eliminating the prevalence of disposable products.

“Until we change the reliance on single-use plastics, and revert to more durable, reusable products,” Gordon says, “we’re not going to see changes in the data set.”

hakaimagazine.com, 31 August 2020

<https://www.hakaimagazine.com>

### “Inactive” ingredients in drugs could have toxic side effects

2020-09-01

Most of us give little thought to the ingredients inside the brightly colored pills that we rely on to keep our bodies functioning. We refer to them as an aspirin or antihistamine without realizing that for most drugs, the major component by mass is not the drug of interest itself, but compounds classified as “inactive” called excipients.

While called inactive, excipients such as dyes, stabilizers, and antioxidants that increase shelf life have not been systematically tested to determine whether they interact with molecular targets in the body. Scientists recently analyzed a wide range of these compounds to determine potential unknown side effects.

The authors first found interaction candidates by predicting how much an excipient looks to the native compounds that act on certain molecular targets, and then tested the hits experimentally. In another approach, the scientists tested widely used excipients against 28 targets that are known to be related to toxicity. Using these two approaches, the authors found 134 side-effect activities. Of these leads, some were further analyzed for their abilities to be toxic to the body and to enter the bloodstream.

One finding was for an antiseptic commonly found in mouthwash. Predicted to interact with a number of biological targets, this compound was shown to be toxic to the body at low levels, and was able to enter the bloodstream at concentrations high enough to interact with at least one biological target. Overall, 134 side-effect activities for 38 excipients were found.

**Using these two approaches, the authors found 134 side-effect activities.**

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## Gossip

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This study highlights how compounds in our drugs not normally considered active can alter our bodies. The authors additionally note the widespread use of some excipients in food and cosmetics that are found at even higher doses than drugs, and the issue of populations that juggle more than one medication and therefore have a higher exposure. While a preliminary piece of work, it highlights the importance of paying close attention to what we add to substances that sustain us.

massivesci.com, 1 September 2020

<https://www.massivesci.com>

### Harry Perkins Institute of Medical Research study finds honeybee venom rapidly kills aggressive breast cancer cells

2020-09-02

Venom from honeybees has been found to rapidly kill aggressive and hard-to-treat breast cancer cells, according to potentially groundbreaking new Australian research.

The study also found when the venom’s main component was combined with existing chemotherapy drugs, it was extremely efficient at reducing tumour growth in mice.

Published in the journal Nature Precision Oncology, the research was conducted at Perth’s Harry Perkins Institute of Medical Research by Dr Ciara Duffy as part of her PhD.

Dr Duffy hopes the discovery could lead to the development of a treatment for triple-negative breast cancer, which accounts for 10 to 15 per cent of all breast cancers and for which there are currently no clinically effective targeted therapies.

She said the honeybee venom had proven extremely potent.

“We found that the venom from honeybees is remarkably effective in killing some of these really aggressive breast cancer cells at concentrations which aren’t as damaging to normal cells,” Dr Duffy said.

The research showed a specific concentration of the venom killed 100 per cent of triple-negative breast cancer and HER2-enriched breast cancer cells within 60 minutes, while having minimal effects on normal cells.

**Bee venom harvested in Perth**

**“We found that the venom from honeybees is remarkably effective in killing some of these really aggressive breast cancer cells at concentrations which aren’t as damaging to normal cells,” Dr Duffy said.**

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Dr Duffy harvested venom from honeybee hives at the University of Western Australia, as well as in Ireland and England.

“Perth bees are some of the healthiest in the world,” she said.

The bees were put to sleep with carbon dioxide and kept on ice before the venom was extracted and injected into the tumours.

She said a component of the venom called melittin had the killing effect.

The researchers reproduced the melittin synthetically and found it mirrored the majority of the anti-cancer effects of the honeybee venom.

“What melittin does is it actually enters the surface, or the plasma membrane, and forms holes or pores and it just causes the cell to die,” Dr Duffy said.

The researchers also discovered within 20 minutes the melittin had another powerful effect.

“We found it was interfering with the main messaging or cancer-signalling pathways that are fundamental for the growth and replication of cancer cells,” she said.

It effectively shut down the signalling pathways for the reproduction of triple-negative and HER2 cancer cells.

#### ‘Incredibly exciting discovery’, Chief Scientist says

Dr Duffy also examined the effect of melittin used in combination with existing chemotherapy drugs such as docetaxel.

She found the holes in breast cancer membranes caused by the melittin allowed the chemotherapy to enter the cell and worked extremely efficiently in reducing tumour growth in mice.

Western Australia’s Chief Scientist, Professor Peter Klinken, said it was a significant development, which provided another example of where compounds in nature could be used to treat human diseases.

“I think it’s incredibly exciting that they’ve made this observation that the molecule melittin can actually affect the cancer cells, but that it can work in combination with other drugs which come from natural products as well, and in combination they’re really knocking these cancer cells on the head,” Professor Klinken said.

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Dr Duffy did not want to use words like breakthrough or cure, stressing this is just the beginning, and much more research needs to be done.

“There’s a long way to go in terms of how we would deliver it in the body and, you know, looking at toxicities and maximum tolerated doses before it ever went further,” she said.

abc.net.au, 2 September 2020

<https://www.abc.net.au>

#### Half of Antarctic ice shelves could collapse in a flash, thanks to warming

2020-08-28

Antarctic ice shelves can disappear astonishingly fast — sometimes in minutes or hours — as meltwater surges through cracks in their surface. And as the atmosphere warms, this phenomenon may become more commonplace; at least half of the ice shelves on the continent are vulnerable to this process, a new study suggests.

These floating ice sheets ring Antarctica’s glaciers and prevent them from sliding into the ocean. Without these icy barriers, glaciers would flow more quickly into the water, causing the continent to shrink and accelerating sea level rise.

#### AY SOUND

The new study, published today (Aug. 26) in the journal Nature, suggests that about 50% to 70% of ice shelves that hold Antarctic glaciers in place could become weak and potentially collapse with surges of meltwater.

“What we find is that the amount of melting is important, but where the melting happens is also important,” said lead author Ching-Yao Lai, a postdoctoral researcher in the Department of Marine Geology & Geophysics at Columbia University’s Lamont-Doherty Earth Observatory in New York. The research highlights which ice shelves are most likely to crumble, but not *when* this dissolution is most likely to occur.

“The time frame over which this process could happen is the biggest question,” Christine Dow, the Canada Research Chair in Glacier Hydrology and Ice Dynamics at the University of Waterloo, who was not involved in the study, told Live Science in an email. **PLAY SOUND**

#### Cracks in the ice

...suggests that about 50% to 70% of ice shelves that hold Antarctic glaciers in place could become weak and potentially collapse with surges of meltwater.

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Some ice shelves float on open water and do not slow glaciers' slide into the sea, because there's no land mass for them to brace against. But ice shelves confined to bays and gulfs create a physical barrier that the slow-moving glaciers butt up against. Lai and her colleagues focused on these so-called buttressing ice shelves.

The buttressing shelves accumulate cracks on their surfaces as glaciers push against them from behind, and cracks also appear as the shelf pushes against the curvature of the shoreline. In addition, the ice shelves stretch out as they flow across the ocean water, due to their velocity, Lai told Live Science. "Usually near the front of ice shelves, it gets stretched the fastest and this kind of breaking occurs," she said.

When warm atmospheric conditions cause the surface of an ice shelf to melt, meltwater can pool in these cracks and cause "hydrofracturing" — a process in which the excess water puts pressure on the ice, deepening the cracks and sometimes triggering a complete collapse of the shelf.

The melt water "can punch through the ice to the ocean in a matter of minutes to hours, as long as there's enough water available to keep on filling the crevasse and keep up the pressure," Dow said. "The crack in the ice then fills up with ocean water," and the shelf may begin to break apart. Scientists theorize that this is what happened to an ice shelf known as Larsen B, which lost 1,255 square miles (3,250 square kilometers) of ice over the course of a few weeks in 2002, [according to The National Snow and Ice Data Center](#). For context, that area of ice is larger than the state of Rhode Island.

To determine which buttressing ice shelves are vulnerable to collapse, Lai and her colleagues developed a machine learning model — an algorithm that can be trained to recognize visual features based on past images it has analyzed. The authors trained their model to recognize surface fractures in the ice using satellite images of two ice shelves, named Larsen C and George VI, in the northwest region of Antarctica, and then applied the model to a [complete map of Antarctica](#).

With their map of ice cracks in hand, the researchers then determined which fractures in Antarctica's many ice shelves would be prone to hydrofracture, given the pressures exerted on them from surrounding land masses and their movement over the water. Researchers have used this analysis at specific ice shelves before, but "this is the first time it has been applied to the Antarctic as a whole," Dow noted.

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The next big question is "how does this hydrofracture process contribute to the sea level rise?" Lai said. To find out, the team will need to pair their model of ice cracks with climate predictions and a model of how ice flows over the bedrock of Antarctica; this ice flows downslope into the ocean "just like rivers flowing downhill," she said.

In the future, this type of research will help the authors determine how fast and how much sea level rise could change due to cracking ice sheets, given rising atmospheric temperatures, Lai noted. As of now, "estimating time scales on which these ice shelves might break up due to surface melting and hydrofracture is beyond the scope of their study," Alison Banwell, a research scientist at the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado Boulder, who was not involved in the study, told Live Science in an email.

Though the researchers don't have a time frame yet, some scientists predict that [climate change](#) may drive massive hydrofracturing events within a matter of decades, according to a 2015 report in the journal [Earth and Planetary Science Letters](#).

"Also, Antarctic ice shelves are currently losing most [of their] mass due to basal melting," or melting on the underside of the ice sheet, "in response to warming ocean temperatures," Banwell added. "It would be interesting to see which ice shelves are most vulnerable due to all three processes," meaning basal melt, surface melt and hydrofracture, combined. Basal melting could make ice shelves more prone to hydrofracture, as the shelves become thin and stretch more easily the more they melt, Lai added.

[livescience.com](#), 28 August 2020

<https://www.livescience.com>

### 'Enormous opportunity': how Australia could become the Saudi Arabia of renewable energy

2020-08-27

Brandon Bickford is only in town for the weekend. The 26-year-old has come back home to Kalbarri, the tiny Western Australian town where he grew up, with his fiancée to visit family. He'll be making the 574km drive back south to Perth on Monday morning.

The young man with an athletic build says growing up here was like living in the flipside of a postcard. In his teenage years he "ran amok" between

**"The idea is to become a low-cost producer of green, renewable hydrogen," says Terry Kallis, one of the project's promoters.**

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the ancient cliffs that hug the coast and the rugged natural landscape that stretches out to the horizon.

“To this day, I say moving to Kalbarri was the best thing mum ever did for me,” Bickford says. “I learned a lot, not just from school but just from being outdoors.”

It wasn't long after graduating high school that he left. Kalbarri has a population of just 1,500. It might be beautiful, but there's no work. For a while Bickford picked up a job on a commercial fishing boat, and then another on an egg farm.

But when he landed a gig on an iron ore mine outside of Geraldton eight years ago, he did like so many others and moved away.

“It sucked moving away,” Bickford says. “But it's the norm here. There's a handful of jobs and if you want to do something else, if you want to build a future for yourself, you've got to leave.”

But that could change. Kalbarri is now the proposed site for a massive 5,000-megawatt renewable hydrogen export operation. Although construction is still 10 years away from breaking ground, should it go ahead, the project will put the tiny town at the bleeding edge of a pioneering technological development in renewable energy.

### Hydrogen goes green

“The idea is to become a low-cost producer of green, renewable hydrogen,” says Terry Kallis, one of the project's promoters.

Like solar and wind power, the technology to make “green” hydrogen from water has been around since the 1970s.

Historically the production of hydrogen relied on fossil fuels to make “brown” or “blue” hydrogen by running an electric current through water using an electrolyser – a device that breaks down water into oxygen and hydrogen.

But today the development of renewable energy has advanced enough that coal or natural gas are no longer needed to create the electric current. The entire process can instead be powered by wind and solar – making green hydrogen possible.

For years, technological development in the sector stalled due to a lack of demand, but that is changing rapidly. Each year the world consumes 70m tonnes of hydrogen to make glass, steel and fertiliser. That figure is

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projected to grow to 90m tonnes by 2050 under the more conservative scenarios.

The Kalbarri proposal aims to take advantage of this by constructing a combined wind and solar plant to power the commercial production of hydrogen from seawater. If all goes well, the gas will then be exported to nations like Korea, Japan and Singapore, countries that – thanks to their geography – cannot make it themselves.

Kallis and his business partner, Peter Sgardelis, have a background in large-scale renewables. Kallis was involved in the construction of the first commercial windfarm in South Australia and Sgardelis worked on the Star of the South offshore windfarm in Victoria.

This experience – along with the growing global interest in renewable hydrogen – has helped attract support from German multinational engineering giant Siemens, which in October last year signed up to build the electrolysers for the project.

“We've seen the costs associated with production of green hydrogen coming down, or coming down sooner than expected,” Kallis says. “We've also seen the development of the electrolyser to commercial scale and people start talking about demand. That has been a missing link.”

The area around Kalbarri – the traditional land of the Nanda people with whom they are currently negotiating a land use agreement – is an obvious choice, he says.

The landscape offers the right type of wind, good exposure to sun, and is close to both ocean and the Dampier-to-Bunbury pipeline – the longest gas pipeline in Australia.

Since the project is being developed in stages, the earliest phases will see hydrogen blended into the liquid natural gas supply before it then pivots to focus on export.

Like any ambitious project that pushes the boundaries of technological and industrial development, it is not without problems to solve.

While the process of making hydrogen from water is well understood, until recently the electrolysers required for the process have not been large and efficient enough to produce in commercial quantities.

The other issue has been transport.

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Moving hydrogen offshore currently requires the gas to be packaged up in ammonia, or cooled 250C below freezing until it forms a liquid that can then be pumped out onto a ship like LNG.

“Those details have yet to be determined, as it will depend on what the buyer wants,” Kallis says. “We’re under no illusions and we make clear this is a very large project, something that will be developed in stages over time.”

Should they succeed, they will be helping to pioneer what may be a whole new industry for Australia.

Enormous economic potential

Many believe hydrogen could play a role in turning Australia into the Saudi Arabia of renewable energy.

“Countries such as Japan, Korea and Germany have already come to Australia, asking for us to export renewable hydrogen for their domestic energy consumption,” says Ken Baldwin, the director of the Energy Change Institute at the Australian National University. “We have enormous opportunities ... [to create wealth and] jobs due to the demand for our energy from these countries.”

In November last year, the CSIRO released the [National Hydrogen Roadmap](#) to plan out how an export industry could be developed. The potential to get in on the ground floor of a future industry has the private sector excited, with a flurry of 30 new proposals for renewable hydrogen projects in Western Australia alone.

Alongside that proposed for Kalbarri, these include other large operations such as the monster 15,000 megawatt hydrogen project being developed in the Pilbara as part of the [Asian Renewable Energy Hub](#).

There are also a series of smaller operations – not all geared for export – including Yara Pilbara’s hydrogen fertiliser plant and Hazer’s \$17m partnership with the Water Corporation to make hydrogen and high-quality graphite from biogas at a wastewater treatment plant in Woodman Point.

It is here that some organisations such as the Grattan Institute have spied an even bigger opportunity.

In a [report](#) released in May, the independent thinktank suggested that instead of focusing on exporting renewable hydrogen as fuel, using it to make green steel may prove easier – and more beneficial.

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Given that steel production makes up 7% of global carbon emissions, Guy Dundas, an economist and co-author of the Grattan Institute study, says demand will inevitably grow for green steel as countries move to decarbonise.

“The idea for us was that hydrogen is a very tricky product to export. So you’d instead use the hydrogen to make the steel and then export the steel overseas,” Dundas says.

“Our estimate was that it would take \$500m in government investment to get that going. We made the case that for green steel, that would be worth it in the long run.”

For its part, the Western Australian state government has needed little convincing.

“[Hydrogen’s] come from being a bunch of nerds in white coats stuck in the back blocks of a multinational tower, to where the hydrogen guys have been moved a few floors higher,” Alannah MacTiernan says. “It’s really exciting.”

As minister assisting the minister for state development, jobs and trade, MacTiernan says things are moving so fast the state government is looking at bringing its development plans forward.

“We can either send our energy overseas just as hydrogen, or as elaborately transformed products,” she says. “If we can produce green hydrogen or green steel, we think we can get a better balance for a transformed economy in dealing with climate change.”

“We want to be having proper scale blending [of hydrogen into LNG pipelines] in the next two years. We’re thinking exports in the next four years. Large-scale exports in the next seven years. And hopefully, the big dream – if we can pull it off – is green steel in a decade’s time.”

True to this vision, the state government has targeted hydrogen for investment as part of its economic response to the pandemic.

When the Western Australian premier, Mark McGowan, announced his Covid-19 recovery plan in mid-July, it specifically set aside \$10m for renewable hydrogen.

While this will do good in the long term, the ambitions of ministers and investors is still measured in months and years for those on the ground in places like Kalbarri.

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## A future in Kalbarri

With little likely to change until construction begins, locals say they are cautiously optimistic. If the nearby national park can be kept safe and the operation is not within visual range of the town, many expect it will bring good things.

Garry Keeffe, the CEO of the local shire of Northampton, says its biggest benefit will be stable work in a place where the last Australian Bureau of Statistics census put the average age at 51.

Promoters say it will bring around 2,500 jobs at the peak of the construction phase and 700 permanent positions to run it – a prospect Keeffe welcomes.

“It’s a great project, no doubt about that,” he says. “If they can develop it to the stage they want, that’s fantastic. But then that’s about 10 years away. That’s where we have to be careful. The technology for the project is still not there yet.”

For his part, Bickford says that as long as Kalbarri doesn’t lose its soul along the way, he sees a better future for the town – although one he may not be able to participate in.

Since moving away he has made another life for himself. He and his fiancée, Angela, are expecting a daughter in December and live in the suburbs outside Perth, close to her family.

Bickford has no plans to move back home in the future with or without the plant – although he’s quick to say that’s not really the point.

Those who are going to benefit most are those kids coming up now, he says. Whatever they decide to do with their life after school – stay or go – at the very least it will give them a meaningful choice about their future.

“Those kids will have direction. I mean, it’s not just one job you’re going to be working at the plant, there’s a range. Engineers. Operators. Even just the construction will mean you can get a trade.

“You could get a whole life out of it, if you wanted it.”

theguardian.com, 27 August 2020

<https://www.theguardian.com>

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## Microplastics in farm soils: A growing concern

2020-08-31

Mary Beth Kirkham hadn’t studied microplastics when she was invited to co-edit a new book about microplastics in the environment—but something stood out to her about the existing research.

“I had read in the literature that...cadmium and other toxic trace elements [are] increased when we have these particulate plastics in the soil. So, that was of concern to me,” Kirkham, a plant physiologist and distinguished professor of agronomy at Kansas State University, told EHN.

Kirkham’s expertise is in water and plant relations and heavy metal uptake, so she decided to conduct her own research in which she cultivated wheat plants exposed to microplastics, cadmium, and both microplastics and cadmium. Then she compared these plants to those grown without either additive. She chose cadmium because it’s poisonous, carcinogenic, and ubiquitous in the environment due to human activity—it’s shed from batteries and car tires, and is naturally found in the phosphate rock used to make agricultural fertilizers.

“Cadmium is everywhere,” said Kirkham.

At the end of the experiment she sent her wheat plants off for analysis, and, validating previous reports, the plants grown with microplastics were more cadmium-contaminated. “The plastics really were acting as the vector for uptake of the cadmium,” she said.

Her experiment became a chapter in the new book, *Particulate Plastics in Terrestrial and Aquatic Environments*.

“I think people just haven’t felt that microplastic uptake by plants is an issue,” said Kirkham. “It just hasn’t been in the public eye.”

Microplastics, loosely defined as plastic pieces smaller than 5 millimeters across, or roughly the size of a small grain of rice, have made their mark on both the global ecosystem and the popular consciousness, famously killing seabirds and raining down on wilderness areas. And while the impacts of ocean microplastics have been the subject of significant media and scientific attention, researchers say that most microplastics are actually accumulating on land, including agricultural areas. One estimate suggested that 107,000 to 730,000 tons of microplastics could be dumped onto agricultural soils in the U.S. and Europe every year, compared to the 93,000 to 236,000 tons that enter the oceans.

**“Cadmium is everywhere,” said Kirkham.**

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Microplastics arrive on farms through processed sewage sludge used for fertilizer, plastic mulches, and are even intentionally added as slow-release fertilizers and protective seed coatings. In just the last few years, an uptick in research has uncovered alarming potential impacts of this contamination on all aspects of agricultural systems from soil quality to human health.

#### Sewage sludge, mulch, and slow-release fertilizers

Luca Nizzetto, a research scientist at the Norwegian Institute for Water Research, began studying microplastics in agricultural soils after he noticed that most research on microplastics focused on oceans.

“Most of the marine sources are actually land-based,” Nizzetto told EHN. “No one was looking at what was happening close to the source.” When his team began evaluating potential land sinks for microplastics they “immediately [identified] agriculture as one of the hot areas.”

Microplastics can enter agricultural lands via sewage sludge, the solids that are filtered out of wastewater, which are commonly used to fertilize agricultural fields. Microplastics get into the wastewater originally through laundry, personal care products, and urban runoff.

Nizzetto said that most of the microplastics are retained in the sludge as the water is cleaned in treatment facilities and, in a 2016 [paper](#), his team estimated that between 125 and 850 tons per million people are annually dumped on European agricultural lands via sewage sludge. Nizzetto also reported in the same paper that roughly 50 percent of sewage sludge is processed for agricultural application in both Europe and the United States.

Microplastics have been [reported](#) in U.S. sewage sludge as early as 1998, and in 2020 researchers [estimated](#) roughly 21,249 metric tons of microplastics are released to U.S. agricultural lands from sewage sludge annually. Because of their recalcitrance in soils, U.S. researchers have even [investigated](#) the possibility of using the contemporary microplastics profile of soils as an indicator of past sewage sludge application.

Microplastics can also enter agricultural soils through the degradation of plastic materials used by farmers. Kirkham said that in the 1950s, plastic covering replaced glass in greenhouses. Plastic mulches were also popularized, becoming commonplace across much of the world. These mulches, sheets of plastic laid out on the ground to suppress weeds,

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warm the soil, and retain moisture, are challenging to recycle and costly to dispose of.

According to Kirkham, farmers may end up piling them up on their land or burning them to avoid disposal costs. Nizzetto said that in some areas, the mulches are simply left to break down into the soil.

Intentionally manufactured microplastics are another source of microplastic emissions to agricultural soils, according to Nizzetto and other researchers that EHN spoke with. These can include plastic encapsulated slow-release fertilizers and plastic coatings intended to protect seeds from microorganisms.

A 2017 [report](#) compiled for the European Commission estimates that up to 8,000 metric tons of plastic from slow-release fertilizers are broadcast onto Western European agricultural soils annually (although they said that a percentage of this may not be microplastics). A 2019 European Chemicals Agency [report](#) listed emission amounts as 10,000 metric tons for slow-release fertilizers, and 500 metric tons for treated seeds every year. Figures for the U.S. were not available.

#### Microplastics alter the physical and biological properties of soils

Sixteen days into Kirkham’s microplastics and cadmium experiment, her plastic-treated wheat plants began to yellow and wilt. Water had been pooling on the top of the soil in the plastic treated plants, but to keep her experiment consistent, she had to give all the plants the same amount of water.

“The particulate plastic appeared to clog the soil pores, prevent aeration of the soil, and cause...the roots to die,” said Kirkham. Plants without microplastics, even the cadmium-contaminated ones, were in much better shape. “It was the plastics that were controlling the growth more than the cadmium.”

Another team of researchers [reported](#) similar results. They found that exposure to plastics resulted in reduced weight, height, chlorophyll content, and root growth of *Arabidopsis thaliana*, a relative of cabbage and broccoli. In this study, the researchers used nanoplastics, which are plastic pieces that are less than 100 nanometers in size. For scale, the novel coronavirus measures 60 to 140 nanometers.

The full impact of microplastics contamination in agricultural soils, particularly as concentrations increase with time, is unknown. However, [studies](#) have shown that microplastics possess physical and

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chemical characteristics that have the potential to alter soil bulk density, microbial communities, water holding capacity, and other properties that influence plant development.

**Earthworm impacts**

Esperanza Huerta Lwanga, a soil scientist affiliated with both Wageningen University & Research in the Netherlands and El Colegio de la Frontera Sur in Mexico, has investigated the effects of microplastics on earthworms, creatures widely considered a boon to farming because of their ability to aid decomposition, add organic nutrients to the soil through their waste castings, and increase the aeration of soil.

“When I was doing research on soil invertebrates’ distribution at different home gardens in Tabasco, Mexico, I found microplastics. And in those soils with microplastics, there were not earthworms,” Huerta Lwanga told EHN.

This observation motivated her to study earthworms directly. In her subsequent experiments, she found that worms attempted to avoid microplastics, but when the soil concentration reached 7 percent, they began to ingest them along with the soil, concentrating the plastics in their castings, and transporting them through different layers of soil. In their 2018 [paper](#), Huerta Lwanga’s team cautioned that rainwater flows through earthworm burrows into groundwater, creating a clear conduit for microplastics to enter groundwater systems.

Huerta Lwanga also said that microplastics caused an 8 percent to 25 percent mortality rate in earthworms depending on the dose. In their [paper](#), she and her colleagues hypothesized that mortality may be partly caused by microplastics abrading the digestive tracts of earthworms, making it more difficult for them to absorb nutrients. Damage to the digestive tracts of earthworms that ingested microplastics has been [documented](#) by other researchers.

Once microplastics enter an ecosystem, they can proliferate through trophic levels, such as when a bird eats an earthworm.

Or when a person eats an apple.

Earlier this year, Yongming Luo, a professor at the Yantai Institute of Coastal Zone Research and the Nanjing Institute of Soil Science in China, and colleagues [reported](#) microplastics accumulation in wheat and lettuce plants exposed to microplastics in a laboratory setting. The researchers grew the plants in hydroponic and soil systems with microplastics that had been laced with fluorescent dyes. The researchers analyzed cross sections

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of the plants under a microscope outfitted to detect the fluorescence. The roots, stems, and leaves lit up.

“For decades scientists have believed that plastic particles are too large to pass through the physical barriers of intact plant tissue. But our new study disproves this assumption,” Luo told EHN.

Luo’s team reported that the microplastics seemed to be entering the plants through cracks in the roots where lateral branching occurs as well as diffusing through cells at the developing root tips.

A team of scientists also [reported](#) earlier this year that they had detected microplastics in Italian supermarket produce including carrots, lettuce, broccoli, potatoes, apples, and pears. The researchers wrote that they found the most microplastics contamination in apples and the least in lettuce, and speculated that the perennial nature of a fruit tree allowed microplastics to accumulate more than in annual crops.

“If microplastics are getting into our vegetables, they are getting into everything that eats vegetables...which means they are in our meat and dairy as well,” said Luo.

Microplastics have previously been detected in honey, beer, and seafood.

With clear and uncontrolled pathways into human food systems, ingestion of microplastics by humans is practically unavoidable, but the consequences of ingestion are as of yet unknown.

Plastic microfibers have been [found](#) in malignant lung tissue biopsies of cancer patients. These plastics were probably inhaled rather than swallowed, but the concern that microplastics can become lodged in tissue and cause dangerous inflammation remains. Studies of mammals forced to ingest microplastics in laboratories have also provided evidence that microplastics can pass through cell walls, move through the body, accumulate in organs, and impact the immune system.

Microplastics are chemically active materials, capable of attracting and binding to compounds known to harm human health. In addition to cadmium, microplastics have been shown to accumulate lead, PCBs, and pesticides. Further, plastics are manufactured with their own suite of toxic compounds, which can include BPA, an endocrine disruptor. Researchers have suggested that both acquired and endogenous compounds could leach out of degrading plastics into their environment, whether that be soil or human tissue.

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"Because we are concerned that microplastics may harm our health... we find it interesting that the precautionary principle is not [being] applied," Sophie Vonk, a researcher at the Plastic Soup Foundation in the Netherlands, a group dedicated to ending plastic pollution, told EHN. "So as long as there's no proof, we just find it okay that we're being exposed to these particles every single day, by our food, water, the air we breathe."

**What to do?**

Since microplastics enter agricultural systems through a variety of means, addressing this issue would require a multi-tiered approach.

The Plastic Soup Foundation has a long standing campaign to eliminate the use of plastic microbeads in personal care products. This would likely reduce the amount of plastic that ends up in sewage sludge. The group also supports limiting single-use plastics generally, as these will ultimately break down to microplastics that end up polluting both ocean and terrestrial environments. "We're not anti-plastic," said Vonk. "We feel like plastic can be very useful for certain purposes, but the way we're using it now is just really, really not clever."

The European Chemicals Agency has proposed an EU-wide ban on intentionally introduced microplastics, including those in personal care products as well as the slow-release fertilizers and seed coatings used in agriculture. Some states in the U.S. have also moved to ban microbeads from personal care products.

To address the plastic mulch issue, Nizzetto said that one helpful step would be to make companies that manufacture plastic mulch films responsible for their recycling and disposal. This would help reduce inappropriate disposal at farms.

The use of biodegradable plastics for mulch has also been proposed, but these polymers potentially come with their own set of problems. For instance, one of Huerta Lwanga's studies found that a biodegradable plastic negatively impacted wheat growth more than a conventional plastic used in the study. Also, there has been controversy over whether some "biodegradable" plastics actually degrade into harmless compounds, or whether they just break down into microplastics faster. Such controversy surrounds oxo-biodegradable plastics, which the EU moved to ban in 2019.

Another alternative to plastic mulch, developed by researchers at the Rodale Institute in Pennsylvania, involves growing nutrient-sequestering

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cover crops and then rolling them down to form a thick mat. Farmers then plant into the mat, which itself persists and inhibits weeds, lets water through, and adds nutrients instead of microplastics to the soil. According to the researchers' report, the technique can replace more than 90 pounds of plastic mulch per acre.

Gladis Zinati, director of the vegetable systems trial at Rodale and co-author on the report, told EHN that the strategy is scalable to large farms and emphasized the importance of building up healthy soils on farmlands to support long term resiliency.

Much more research is needed to paint a complete picture of the scope and impacts of microplastic pollution of agricultural soils. But in the meantime, the plastics will continue to accumulate.

"This is a kind of irreversible contamination," said Nizzetto. "There's no way to remediate this kind of contamination at the scale of agricultural soils."

ehn.org, 31 August 2020

<https://www.ehn.org>

**Is the rush to roll out a coronavirus vaccine undermining safety?**

2020-08-26

US PRESIDENT Donald Trump is considering allowing the usual procedures to be bypassed so an experimental coronavirus vaccine can be made available to the public in time for the US election in November, according to a report in the *Financial Times*. AstraZeneca, the drug company developing the vaccine in partnership with the University of Oxford, has said there have been no talks with the US government about fast-tracking the vaccine.

But the race to develop a coronavirus vaccine is speeding up. On 11 August, president Vladimir Putin announced that Russia had approved a vaccine called Sputnik V for widespread use after only two months of small-scale trials, before the usual longer, large-scale trials. China has also allowed volunteers to be given a vaccine although human trials are still running.

These decisions have led to concern that too many shortcuts are being taken in the rush to roll out coronavirus vaccines.

**These decisions have led to concern that too many shortcuts are being taken in the rush to roll out coronavirus vaccines.**

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“There is no possible room for movement on the highest safety standards,” says Danny Altmann at Imperial College London. “The [covid-19] vaccines will be given to billions in the biggest ever medical endeavour on planet Earth. This needs to be effective and safe. Imagine even one in 1000 serious adverse events in a vaccine given to a billion people.”

Vaccines typically take a decade or more to go through the development and testing phases required to ensure a safe and effective dosage that most people will tolerate. The first step is to make a potential vaccine, a process that can take many years. As of 20 August, [139 potential coronavirus vaccines](#) are in this initial stage, according to the World Health Organization. A further 30 are already being tested in people (see “[How vaccines get to the front line](#)”).

“The Russia vaccine approval was definitely rushed,” says Ayfer Ali at the University of Warwick in the UK. “It had only been tested on 38 people.”

But she says other research groups and pharmaceutical companies are going through the standard stages of vaccine development. Some are hoping for approval near the end of this year.

So how is the development of coronavirus vaccines proceeding so much faster than normal if researchers really are taking all the usual precautions? One reason is the unprecedented effort being made. When the pandemic began, thousands of researchers around the world dropped what they were doing and concentrated on the coronavirus instead.

“The research world is focusing on covid-19 with an intensity the likes of which we have not seen before,” says Michael Head at the University of Southampton, UK. “With these resources available, and the urgency of the pandemic, research is happening much faster than in normal times.”

The necessary technologies have also advanced greatly in recent decades. Genetic sequencing is now fast, routine and cheap, for instance. The full sequence of the coronavirus was made public by researchers in China on 10 January, just weeks after the first cases emerged.

Thanks to studies of other coronaviruses, including the ones that cause SARS and MERS, researchers knew which part of the genome coded for the so-called spike protein that protrudes from the outside of the virus. This is the part our immune system learns to recognise and the key target of most coronavirus vaccines. With this, researchers could get started on a vaccine as soon as they had the gene sequence.

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What’s more, several groups worldwide had been developing ways of making new vaccines quickly. A Massachusetts-based firm called Moderna, for example, was already working on RNA vaccines, which stimulate our cells to make a viral protein that provokes an immune response.

Once Moderna had the gene sequence for the coronavirus spike protein, it pretty much had its candidate coronavirus vaccine, with a bit of tweaking to ensure the protein has the right structure.

Several other potential vaccines, including Sputnik V and the Oxford vaccine, work in much the same way, but use the shell of a cold-causing virus called an adenovirus to deliver the gene for the spike protein to human cells. Again, once these groups had the spike protein gene, they could create vaccines extremely quickly.

What is happening after candidate vaccines have been created is more debatable. Normally, a potential vaccine would be tested in animals and there would then be a pause while the results are assessed. It can take months or years for funders, regulators and ethics boards to give the go-ahead for the next step.

That step is to test a candidate vaccine in a small number of people, usually fewer than 100, to check there are no serious adverse reactions. This is called a phase I trial.

**Bridging the gaps**

There would then be another pause before phase II, when the vaccine is given to more people – perhaps several hundred – and their immune responses studied to work out the most effective dosage, and how many doses are required.

Another gap then comes before phase III trials, in which typically thousands of people are given either the vaccine or a placebo to see whether the vaccine really can prevent infection.

But most groups developing coronavirus vaccines aren’t pausing between stages. Instead, they are overlapping them.

“As soon as they get a good safety signal from phase I, they are going to phase II,” says Eleanor Riley at the University of Edinburgh, UK. “Essentially, the funders have said: ‘Keep going, the money will be there.’”

For instance, Moderna did hardly any animal tests before giving its experimental vaccine to the first volunteer on 16 March. The company didn’t respond when asked to comment on this.

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By contrast, there was extensive testing of the Sputnik V vaccine in rats, mice, hamsters, guinea pigs, rabbits and monkeys, said Alexander Gintsburg at the Gamaleya Research Institute of Epidemiology and Microbiology in Moscow, during a press briefing on 20 August.

However, Riley thinks skipping animal tests may be justifiable because we have enough experience of using RNA vaccines to know that they are fairly safe, she says. "As long as there are no new, untested components in the Moderna vaccine cocktail, then the need for animal safety tests is arguable."

The question is, are vaccine groups taking risks by moving to the next stage so fast? "I guess you could say that they possibly have not fully analysed phase I, but I'm not sure there's any evidence for that," says Riley.

If there is any extra risk, it is to the volunteers in trials. "Once you've done your phase I and you're pretty sure the vaccine delivery and the few weeks after it is safe, then any other consequences tend to be rare and they don't rear their heads until you've vaccinated thousands of people," says Riley.

So, as long as large studies are done and the results are judged by the usual standards, coronavirus vaccines should be as safe as any other newly approved vaccine. Testing each one on large numbers of people matters more than time when it comes to spotting rare adverse events, says Riley.

However, it is unclear whether the usual standards are always being applied right now. Putin's announcement, for instance, suggested that Russia was going to skip phase III trials. That isn't quite the case, according to Gintsburg. He said that only people in high-risk groups will be given the vaccine straight away. At the same time, a trial involving 40,000 people will be carried out, ahead of the vaccine's mass deployment in October.

Regulators in most other countries haven't said what will be needed for a coronavirus vaccine to get approval, but in the US, the Food and Drug Administration has said it would only need to protect 50 per cent of people, and perhaps even just 30 per cent.

"That is unusually low protectivity for an approved vaccine," says Jonathan Kimmelman at McGill University in Canada. With vaccines, it is all about the risk-benefit ratio, he says.

The big danger with approving a vaccine that only protects some people is that all recipients may assume they are shielded from covid-19 and engage in more risky behaviour than they would otherwise.

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On the positive side, these vaccines may get far more scrutiny than is typical because of the immense interest in them and there being greater transparency than usual. Many vaccine groups are publishing their results as they go along, which are making headlines around the world.

"Clinical trial data is not usually available to the public, it is mostly the regulators that see it," says Ali.

There has been unprecedented openness and this needs to continue, says Derek Lowe, a drug discovery chemist based in Massachusetts. "The phase II and III data have to be out on the table, so everyone can see how we're making the decisions about which candidates are better or worse than others," he says. "Secrecy would be a disaster."

**Multiple vaccines**

Furthermore, never before have so many vaccines for the same disease been developed simultaneously. "A unique situation we have is that we'll likely have multiple vaccines," says Harald Schmidt at the University of Pennsylvania.

So even if the first vaccines to get approval are only partially effective, they may soon be replaced by better ones. After all, it is going to take years to vaccinate everyone on the planet.

"But nobody is yet through the big, difficult bottleneck of successful, safe phase III trials, so let's not count any chickens," says Altmann.

The duration of immunity given by a vaccine will also not be clear after early trials. "Given hopes to have a vaccine by year end and where we are with trials, by necessity, we'll only know that they protect for three months," says Schmidt.

People in the phase III trials are told to take all the usual precautions to avoid infection, not least because half of them were given a placebo rather than the vaccine. So it could take many months for it become clear whether a vaccine works – especially in countries where case numbers are low – and far longer to know how long protection lasts.

But there is a big shortcut we could take: human challenge studies. With one of these, researchers would give people a vaccine and then deliberately infect them with the coronavirus to see if it works. Tens of thousands of people have already expressed a desire to volunteer. However, so far it has been regarded as too risky to try, given that there is no treatment that can guarantee survival from covid-19.

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Assuming at least some vaccines do prove effective, the next challenge is churning out billions of doses. And even after any vaccines are rolled out to the public, monitoring will continue, in what is sometimes called phase IV. Many of the approvals are likely to initially be so-called conditional emergency use authorisations, with full approval coming later.

"It is still possible that some extremely rare events will not be captured in trials – that is true of any drug or vaccine – but after phase III trials, this is a minuscule risk," says Ali. "I expect scrutiny after approval will be immense for covid-19 vaccines, as it has been so far for covid-19 scientific research."

It is unusual for serious adverse events to emerge after vaccines are rolled out, says Riley, but it does happen occasionally. For instance, a vaccine against H1N1 swine flu was linked with cases of narcolepsy, though this finding remains controversial. There was also a [rise in narcolepsy](#) in China, where the vaccine wasn't used, probably due to the virus itself.

Even if any vaccine did turn out to cause a rare adverse effect, people might still be better off being given it. Keith Neal at the University of Nottingham in the UK points out how deadly the coronavirus can be, especially in those aged 60 or above. "I doubt if the vaccines have anywhere near that risk," he says. "We are in a public health emergency."

It is also possible that coronavirus vaccines might turn out to have [unexpected benefits](#), like some other vaccines. For instance, the HPV vaccine intended to prevent cervical cancer has also reduced the number of premature births.

Overall, Kimmelman thinks there are some increased risks from the shortening of the usual vaccine development process. But this is being offset by the far greater resources and scrutiny. "How that balances out is anybody's guess," he says.

Kimmelman also worries that politics and nationalism could influence the approval process, as seems to have happened in Russia.

Altmann echoes these concerns. "I have lost sleep that the knock-on from the Sputnik V announcement could lead to a cold war space race between populist politicians seeking to strong-arm regulatory bodies into rushed approvals," he says. So far, there is no sign of this, he says.

The stakes couldn't be higher. "A rushed, unsafe vaccine could undermine public confidence, feeding directly into the rhetoric of anti-vaccine

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activists, and add fire to their existing body of lies and misinformation," says Head. "That could risk extending the pandemic by months or years."

[newscientist.com](https://www.newscientist.com), 26 August 2020

<https://www.newscientist.com>

### The three scariest chemicals to watch out for in your home

2020-08-26

Many years ago I spent a semester abroad in Lancaster, England, studying ecotoxicology, which essentially examines all the horrible chemicals swirling around the modern world. Suddenly, Great Britain seemed less a country than a massive pile of toxic chemicals off the coast of Europe. There were the POPs, PCBs, PBDEs, plus DDT and BPA; there was lead, mercury, arsenic and cadmium. Dioxins, glyphosate, microplastics, oh my!

It was so overwhelming I just tried to put it all out of my mind. Through my invincible 20s, I lived in apartments with lead paint where I heated plastic-wrapped meals in the microwave, ignoring the dangers for the sake of cheap rent and greasy fast food.

But now I'm a dad and there's a lot more at stake than just my health. How do I keep these chemicals from hurting my kid? Should I crack my dusty ecotox books? You need a Ph.D. to understand half of them. I needed someone to sort out the crazy acronyms and inscrutable jargon. Just tell me, what are the three biggest chemical threats to my family's safety?

So I called Liza Gross. Not only is she an award-winning science writer who has covered toxic chemicals for more than two decades, she [wrote the book on investigative science journalism](#). She's not a scientist by training, but came to the topic after researching a [story on cancer](#) in 1999 and has been hooked ever since.

I asked her to pick the worst chemicals that parents encounter each day and write about them. Simply put, what are the three toxic chemicals most likely to affect our homes and children? Liza promptly laughed straight into my phone's earpiece.

"I mean, there are so many thousands of unregulated chemicals and even regulated chemicals," she said. "It's not as if we're like lab rats that are exposed to one chemical all the time."

**There were the POPs, PCBs, PBDEs, plus DDT and BPA; there was lead, mercury, arsenic and cadmium. Dioxins, glyphosate, microplastics, oh my!**

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It was like asking the director J.J. Abrams to list the top three movies of all time — including ones he hasn't seen. That's the problem with synthetic chemicals that affect our health: There are too many, they are everywhere and only a few have been well studied. Nevertheless, Liza took the assignment — and has been cursing my name every day since.

"I think you might have chosen me because you know I'm insane," she said, months later. "I figured you knew that it was an impossible task."

Liza called leading scientists, advocates and physicians who, after laughing in *her* earpiece, helped compile a list of 10 or so of the best candidates. She then painstakingly whittled the list to three: phthalates; PFAS, or per- and polyfluoroalkyl substances; and flame retardants. All three groups of chemicals appear throughout our homes and can disrupt our hormone, or endocrine, systems. [Phthalates can impair fertility](#), PFAS can affect pregnancy and flame retardants can interfere with child development. The triple crown of toxicity.

Along the way, Liza has gone down endless rabbit holes. She's learned that [the placenta does not block](#) as many chemicals as doctors assume. She's seen that when a law bans one dangerous or lethal chemical, companies start producing a slightly different one that does the same thing, dryly called "regrettable substitutes" by scientists.

"We're talking about scientists, who tend to be the masters of understatement," she said.

Mostly she has found mothers bear an unequal share of the burden to protect kids from exposure to toxic chemicals. And that a chemical that is safe for a 25-year-old woman may not be safe for a fetus or a child. Something she encounters as a kid may have effects decades later.

It's not fair that parents need a Ph.D. in biochemistry to read labels. It's not fair that companies often don't disclose potentially harmful chemicals in their products. But this is the world we live in. So, over the next few weeks, NYT Parenting will examine the three chemicals that Liza identified. And perhaps suggest a few ways we might make our chemical world a little safer for the next generation.

[nytimes.com](https://www.nytimes.com), 26 August 2020

<https://www.nytimes.com>

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### Some mosquitoes already have resistance to the latest weapon against malaria

2020-08-31

An insecticide about to be widely deployed inside African homes to combat malaria-carrying mosquitoes is already losing its punch. Two years ago, the World Health Organization (WHO) gave the green light for clothianidin, long used in agriculture to kill crop pests, to be added to the current mainstays of indoor mosquito control, which are losing their effectiveness as the insects develop resistance. Since then, many African countries have been laying plans to spray the walls of homes with the pesticide—it would represent the first new class of chemicals adopted for such use in decades—and looking anxiously for evidence of pre-existing resistance.

Now, scientists at Cameroon's Centre for Research in Infectious Diseases (CRID) have found it. They recently sampled mosquitoes from rural and urban areas around Yaoundé, the capital, including two key malaria carriers. In one standard susceptibility assay, exposure to clothianidin for 1 hour killed 100% of *Anopheles coluzzii*. But in some *A. gambiae* samples as many as 55% of the mosquitoes survived, the group reported in a preprint posted 7 August on the bioRxiv preprint server.

Corine Ngufor, a medical entomologist at the London School of Hygiene & Tropical Medicine, says this appears to be the first report of clear resistance to clothianidin in malaria-carrying insects. "It may spread very quickly and make this new class of insecticide almost useless for malaria vector control within a few years," she warns.

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Colince Kamdem, the CRID research scientist who led the study, says agricultural use of neonicotinoids—the class of chemicals to which clothianidin belongs—likely drove the emergence of the resistant mosquito strains. "WHO would never have recommended this insecticide if such data were available," he contends.

Tiaan de Jager, director of the University of Pretoria Institute for Sustainable Malaria Control in South Africa, says the study shows it is crucial to test malaria vectors for resistance to an insecticide before deploying it. "It proves how important it is to tailor control methods to a region, such as an area of high agriculture, to ensure the success of the methods and overall program," he says. "Other novel insecticide chemistries are urgently needed for malaria vector control," Ngufor adds.

**"It may spread very quickly and make this new class of insecticide almost useless for malaria vector control within a few years," she warns.**

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Bed nets coated with long-lasting insecticides and indoor spraying have helped halve malaria mortality and morbidity in the past 2 decades. These programs used insecticides from four classes but relied heavily on pyrethroids because they are cheap and nontoxic to mammals including humans, Kamdem says.

To combat the rise of pyrethroid-resistant mosquitoes, WHO added clothianidin to its “prequalified” list of chemicals acceptable for indoor spraying (and potentially nets). Neonicotinoids have become increasingly controversial as agricultural pesticides because of their impacts on pollinators; Europe has banned their use in agriculture. But farms in Cameroon and elsewhere in Africa rely heavily on them. In agricultural areas, Kamdem says, pesticide residues contaminate standing water that serves as breeding sites for mosquito larvae, favoring the evolution of neonicotinoid resistance.

The Cameroon finding doesn’t surprise German life science company Bayer AG, which manufactures one of the two formulations of clothianidin that malaria programs are considering for indoor spraying. “We supported some work in Côte d’Ivoire to also explore this and it seemed to suggest the same kind of finding, that there was already resistance to the family of insecticides that clothianidin belongs to,” says Sebastian Horstmann, Bayer’s product development manager for the clothianidin formulation. Horstmann says that to thwart, or at least slow, resistance, Bayer is developing new formulations with multiple insecticides for indoor spraying. But Kamdem notes those combinations have yet to be tested on resistant mosquitoes because none had been identified until now.

WHO has not reviewed the study because it has not yet been published in a peer-reviewed journal, says Deusdedit Mubangizi, who coordinates the agency’s “prequalification” assessments of active pharmaceutical products and medicines including insecticides used for mosquito control. But he thinks the chemical could still be an asset in mosquito control. “Resistance to clothianidin is much less prevalent than to other alternative insecticides in current use,” he says. But how long that will last is the great unknown—and concern.

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sciencemag.org, 31 August 2020

<https://www.sciencemag.org>

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### Hand sanitizers sold in beer cans and children’s food pouches? Don’t buy them, FDA says

2020-08-29

Some hand sanitizer products are being packaged in containers typically used for food and drinks, leading to concerns that people may accidentally ingest the products, according to health officials.

On Thursday (Aug. 27), the U.S. Food and Drug Administration (FDA) warned consumers about these hand sanitizer products, which have been packaged in a variety of potentially misleading containers, including beer cans, water bottles, juice bottles, vodka bottles and children’s food pouches, the agency said in a statement. In addition, officials have found hand sanitizers with food flavors, such as chocolate and raspberry.

Hand sanitizers typically contain 60% to 70% alcohol, so can be toxic when ingested, particularly for young children who may develop alcohol poisoning.

“I am increasingly concerned about hand sanitizer being packaged to appear to be consumable products,” FDA Commissioner Dr. Stephen Hahn said in the statement. “These products could confuse consumers into accidentally ingesting a potentially deadly product.”

For example, the FDA recently received a report about a person who purchased what they thought was a bottle of water, but was actually hand sanitizer. The agency also learned about a hand sanitizer product sporting cartoons for children and packaged in a container that resembled a snack pouch, the statement said.

The FDA has identified safety issues with numerous hand sanitizer products, which have flooded the market amid the COVID-19 pandemic. Since June, the agency has found dozens of hand sanitizer products that contain methanol, a toxic substance that can cause nausea, vomiting, permanent blindness, seizures and even death if ingested, Live Science previously reported.

A recent report from the Centers for Disease Control and Prevention found that at least four people in the U.S. have died after drinking methanol-tainted hand sanitizer, and about a dozen more have experienced serious health effects such as vision loss and seizures, Live Science previously reported.

The FDA said it will continue to work with manufacturers to recall potentially dangerous hand sanitizer products and remove them from

**In addition, officials have found hand sanitizers with food flavors, such as chocolate and raspberry.**

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the market. The agency also keeps a running list of risky hand sanitizer products that people should not use. In early July, the FDA updated this list to include a warning about hand sanitizer products packaged as food or drinks. But Thursday's warning highlights this issue and provides more detailed information.

*Originally published on Live Science.*

livescience.com, 29 August 2020

<https://www.livescience.com>

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### A super computer analyzed Covid-19—and an interesting new theory has emerged

2020-09-02

Earlier this summer, the Summit supercomputer at Oak Ridge National Lab in Tennessee set about crunching data on more than 40,000 genes from 17,000 genetic samples in an effort to better understand Covid-19. Summit is the second-fastest computer in the world, but the process — which involved analyzing 2.5 billion genetic combinations — still took more than a week.

When Summit was done, researchers analyzed the results. It was, in the words of Dr. Daniel Jacobson, lead researcher and chief scientist for computational systems biology at Oak Ridge, a “eureka moment.” The computer had revealed a new theory about how Covid-19 impacts the body: the bradykinin hypothesis. The hypothesis provides a model that explains many aspects of Covid-19, including some of its most bizarre symptoms. It also suggests 10-plus potential treatments, many of which are already FDA approved. Jacobson's group published their results in a paper in the journal *eLife* in early July.

According to the team's findings, a Covid-19 infection generally begins when the virus enters the body through ACE2 receptors in the nose, (The receptors, which the virus is known to target, are abundant there.) The virus then proceeds through the body, entering cells in other places where ACE2 is also present: the intestines, kidneys, and heart. This likely accounts for at least some of the disease's cardiac and GI symptoms.

But once Covid-19 has established itself in the body, things start to get really interesting. According to Jacobson's group, the data Summit analyzed shows that Covid-19 isn't content to simply infect cells that already express lots of ACE2 receptors. Instead, it actively hijacks the body's own systems, tricking it into upregulating ACE2 receptors in places where they're usually expressed at low or medium levels, including the lungs.

In this sense, Covid-19 is like a burglar who slips in your unlocked second-floor window and starts to ransack your house. Once inside, though, they don't just take your stuff — they also throw open all your doors and windows so their accomplices can rush in and help pillage more efficiently.

The renin–angiotensin system (RAS) controls many aspects of the circulatory system, including the body's levels of a chemical called bradykinin, which normally helps to regulate blood pressure. According

**The computer had revealed a new theory about how Covid-19 impacts the body: the bradykinin hypothesis.**

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to the team's analysis, when the virus tweaks the RAS, it causes the body's mechanisms for regulating bradykinin to go haywire. Bradykinin receptors are resensitized, and the body also stops effectively breaking down bradykinin. (ACE normally degrades bradykinin, but when the virus downregulates it, it can't do this as effectively.)

The end result, the researchers say, is to release a bradykinin storm — a massive, runaway buildup of bradykinin in the body. According to the bradykinin hypothesis, it's this storm that is ultimately responsible for many of Covid-19's deadly effects. Jacobson's team says in their paper that "the pathology of Covid-19 is likely the result of Bradykinin Storms rather than cytokine storms," which had been previously identified in Covid-19 patients, but that "the two may be intricately linked." Other papers had previously identified bradykinin storms as a possible cause of Covid-19's pathologies.

As bradykinin builds up in the body, it dramatically increases vascular permeability. In short, it makes your blood vessels leaky. This aligns with recent clinical data, which increasingly views Covid-19 primarily as a vascular disease, rather than a respiratory one. But Covid-19 still has a massive effect on the lungs. As blood vessels start to leak due to a bradykinin storm, the researchers say, the lungs can fill with fluid. Immune cells also leak out into the lungs, Jacobson's team found, causing inflammation.

And Covid-19 has another especially insidious trick. Through another pathway, the team's data shows, it increases production of hyaluronic acid (HLA) in the lungs. HLA is often used in soaps and lotions for its ability to absorb more than 1,000 times its weight in fluid. When it combines with fluid leaking into the lungs, the results are disastrous: It forms a hydrogel, which can fill the lungs in some patients. According to Jacobson, once this happens, "it's like trying to breathe through Jell-O."

This may explain why ventilators have proven less effective in treating advanced Covid-19 than doctors originally expected, based on experiences with other viruses. "It reaches a point where regardless of how much oxygen you pump in, it doesn't matter, because the alveoli in the lungs are filled with this hydrogel," Jacobson says. "The lungs become like a water balloon." Patients can suffocate even while receiving full breathing support.

The bradykinin hypothesis also extends to many of Covid-19's effects on the heart. About one in five hospitalized Covid-19 patients have damage to their hearts, even if they never had cardiac issues before. Some of this

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is likely due to the virus infecting the heart directly through its ACE2 receptors. But the RAS also controls aspects of cardiac contractions and blood pressure. According to the researchers, bradykinin storms could create arrhythmias and low blood pressure, which are often seen in Covid-19 patients.

The bradykinin hypothesis also accounts for Covid-19's neurological effects, which are some of the most surprising and concerning elements of the disease. These symptoms (which include dizziness, seizures, delirium, and stroke) are present in as many as half of hospitalized Covid-19 patients. According to Jacobson and his team, MRI studies in France revealed that many Covid-19 patients have evidence of leaky blood vessels in their brains.

Bradykinin — especially at high doses — can also lead to a breakdown of the blood-brain barrier. Under normal circumstances, this barrier acts as a filter between your brain and the rest of your circulatory system. It lets in the nutrients and small molecules that the brain needs to function, while keeping out toxins and pathogens and keeping the brain's internal environment tightly regulated.

If bradykinin storms cause the blood-brain barrier to break down, this could allow harmful cells and compounds into the brain, leading to inflammation, potential brain damage, and many of the neurological symptoms Covid-19 patients experience. Jacobson told me, "It is a reasonable hypothesis that many of the neurological symptoms in Covid-19 could be due to an excess of bradykinin. It has been reported that bradykinin would indeed be likely to increase the permeability of the blood-brain barrier. In addition, similar neurological symptoms have been observed in other diseases that result from an excess of bradykinin."

Increased bradykinin levels could also account for other common Covid-19 symptoms. ACE inhibitors — a class of drugs used to treat high blood pressure — have a similar effect on the RAS system as Covid-19, increasing bradykinin levels. In fact, Jacobson and his team note in their paper that "the virus... acts pharmacologically as an ACE inhibitor" — almost directly mirroring the actions of these drugs.

By acting like a natural ACE inhibitor, Covid-19 may be causing the same effects that hypertensive patients sometimes get when they take blood pressure-lowering drugs. ACE inhibitors are known to cause a dry cough and fatigue, two textbook symptoms of Covid-19. And they can potentially increase blood potassium levels, which has also been observed in Covid-19 patients. The similarities between ACE inhibitor side effects and

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Covid-19 symptoms strengthen the bradykinin hypothesis, the researchers say.

ACE inhibitors are also known to cause a loss of taste and smell. Jacobson stresses, though, that this symptom is more likely due to the virus "affecting the cells surrounding olfactory nerve cells" than the direct effects of bradykinin.

Though still an emerging theory, the bradykinin hypothesis explains several other of Covid-19's seemingly bizarre symptoms. Jacobson and his team speculate that leaky vasculature caused by bradykinin storms could be responsible for "Covid toes," a condition involving swollen, bruised toes that some Covid-19 patients experience. Bradykinin can also mess with the thyroid gland, which could produce the thyroid symptoms recently observed in some patients.

The bradykinin hypothesis could also explain some of the broader demographic patterns of the disease's spread. The researchers note that some aspects of the RAS system are sex-linked, with proteins for several receptors (such as one called TMSB4X) located on the X chromosome. This means that "women... would have twice the levels of this protein than men," a result borne out by the researchers' data. In their paper, Jacobson's team concludes that this "could explain the lower incidence of Covid-19 induced mortality in women." A genetic quirk of the RAS could be giving women extra protection against the disease.

The bradykinin hypothesis provides a model that "contributes to a better understanding of Covid-19" and "adds novelty to the existing literature," according to scientists Frank van de Veerdonk, Jos WM van der Meer, and Roger Little, who peer-reviewed the team's paper. It predicts nearly all the disease's symptoms, even ones (like bruises on the toes) that at first appear random, and further suggests new treatments for the disease.

As Jacobson and team point out, several drugs target aspects of the RAS and are already FDA approved to treat other conditions. They could arguably be applied to treating Covid-19 as well. Several, like danazol, stanozolol, and ecallantide, reduce bradykinin production and could potentially stop a deadly bradykinin storm. Others, like icatibant, reduce bradykinin signaling and could blunt its effects once it's already in the body.

Interestingly, Jacobson's team also suggests vitamin D as a potentially useful Covid-19 drug. The vitamin is involved in the RAS system and could prove helpful by reducing levels of another compound, known as REN.

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Again, this could stop potentially deadly bradykinin storms from forming. The researchers note that vitamin D has already been shown to help those with Covid-19. The vitamin is readily available over the counter, and around 20% of the population is deficient. If indeed the vitamin proves effective at reducing the severity of bradykinin storms, it could be an easy, relatively safe way to reduce the severity of the virus.

Other compounds could treat symptoms associated with bradykinin storms. Hymecromone, for example, could reduce hyaluronic acid levels, potentially stopping deadly hydrogels from forming in the lungs. And timbetasin could mimic the mechanism that the researchers believe protects women from more severe Covid-19 infections. All of these potential treatments are speculative, of course, and would need to be studied in a rigorous, controlled environment before their effectiveness could be determined and they could be used more broadly.

Covid-19 stands out for both the scale of its global impact and the apparent randomness of its many symptoms. Physicians have struggled to understand the disease and come up with a unified theory for how it works. Though as of yet unproven, the bradykinin hypothesis provides such a theory. And like all good hypotheses, it also provides specific, testable predictions — in this case, actual drugs that could provide relief to real patients.

The researchers are quick to point out that "the testing of any of these pharmaceutical interventions should be done in well-designed clinical trials." As to the next step in the process, Jacobson is clear: "We have to get this message out." His team's finding won't cure Covid-19. But if the treatments it points to pan out in the clinic, interventions guided by the bradykinin hypothesis could greatly reduce patients' suffering — and potentially save lives.

[elemental.medium.com](https://www.elemental.medium.com), 2 September 2020

<https://www.elemental.medium.com>

### What's behind August 2020's extreme weather? Climate change and bad luck

2020-08-27

August 2020 has been a devastating month across large swaths of the United States: As powerful Hurricane Laura barreled into the U.S. Gulf Coast on August 27, fires continued to blaze in California. Meanwhile,

**To date, these fires have burned more than 520,000 hectares.**

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farmers are still assessing widespread damage to crops in the Midwest following an Aug. 10 “derecho,” a sudden, hurricane-force windstorm.

Each of these extreme weather events was the result of a particular set of atmospheric — and in the case of Laura, oceanic — conditions. In part, it’s just bad luck that the United States is being slammed with these events back-to-back-to-back. But for some of these events, such as intense hurricanes and more frequent wildfires, scientists have long warned that climate change has been setting the stage for disaster.

*Science News* takes a closer look at what causes these kinds of extreme weather events, and the extent to which human-caused climate change may be playing a role in each of them.

### California wildfires

A “dry lightning” storm, which produced nearly 11,000 bursts of lightning between August 15 and August 19, set off devastating wildfires in across California. To date, these fires have burned more than 520,000 hectares.

That is “an unbelievable number to say out loud, even in the last few years,” says climate scientist Daniel Swain, of the Institute of the Environment and Sustainability at UCLA.

The storm itself was the result of a particular, unusual set of circumstances. But the region was already primed for fires, the stage set by a prolonged and record-breaking heat wave in the western United States — including one of the hottest temperatures ever measured on Earth, at Death Valley, Calif. — as well as extreme dryness in the region (*SN*: 8/17/20). And those conditions bear the fingerprints of climate change, Swain says.

The extreme dryness is particularly key, he adds. “It’s not just incremental; it absolutely matters *how* dry it is. You don’t just flip a switch from dry enough to burn to not dry enough to burn. There’s a wide gradient up to dry enough to burn explosively.”

Both California’s average heat and dryness have become more severe due to climate change, dramatically increasing the likelihood of extreme wildfires. In an Aug. 20 study in *Environmental Research Letters*, Swain and colleagues noted that over the last 40 years, average autumn temperatures increased across the state by about 1 degree Celsius, and statewide precipitation dropped by about 30 percent. That, in turn, has more than doubled the number of autumn days with extreme fire weather conditions since the early 1980s, they found.

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Although fall fires in California tend to be more wind-driven, and summertime fires more heat-driven, studies show that the fingerprint of climate change is present in both, Swain says. “A lot of it is very consistent with the long-term picture that scientists were suggesting would evolve.”

Though the stage had been set by the climate, the particular trigger for the latest fires was a “dry lightning” storm that resulted from a strange confluence of two key conditions, each in itself rare for the region and time of year. “Freak storm’ would not be too far off,” Swain says.

The first was a plume of moisture from Tropical Storm Fausto, far to the south, which managed to travel north to California on the wind and provide just enough moisture to form clouds. The second was a small atmospheric ripple, the remnants of an old thunderstorm complex in the Sonoran Desert. That ripple, Swain says, was just enough to kick-start mixing in the atmosphere; such vertical motion is the key to thunderstorms. The resulting clouds were stormy but very high, their bases at least 3,000 meters aboveground. They produced plenty of lightning, but most rain would have evaporated during the long dry journey down.

Possible links between climate change and the conditions that led to such a dry lightning storm would be “very hard to disentangle,” Swain says. “The conditions are rare to begin with, and not well modeled from a weather perspective.”

But, he adds, “we know there’s a climate signal in the background conditions that allowed that rare event to have the outcome it did.”

### Midwest derecho

On August 10, a powerful windstorm with the ferocity of a hurricane traveled over 1,200 kilometers in just 14 hours, leaving a path of destruction from eastern South Dakota to western Ohio.

The storm was what’s known as a derecho, roughly translating to “straight ahead.” These storms have winds rivaling the strength of a hurricane or tornado, but push forward in one direction instead of rotating. By definition, a derecho produces sustained winds of at least 93 kilometers per hour (similar to the fury of tropical storm-force winds), nearly continuously, for at least 400 kilometers. Their power is equally devastating: The August derecho flattened millions of hectares of crops, uprooted trees, damaged homes, flipped trucks and left hundreds of thousands of people without power.

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The Midwest has had many derechos before, says Alan Czarnetzki, a meteorologist at the University of Northern Iowa in Cedar Falls. What made this one significant and unusual was its intensity and scale — and, Czarnetzki notes, the fact that it took even researchers by surprise.

Derechos originate within a mesoscale convective system — a vast, organized system of thunderclouds that are the basic building block for many different kinds of storms, including hurricanes and tornadoes. Unlike the better-known rotating supercells, however, derechos form from long bands of swiftly moving thunderstorms, sometimes called squall lines. In hindsight, derechos are easy to recognize. In addition to the length and strength conditions, derechos acquire a distinctive bowl-like shape on radar images; this one appeared as though the storm was aiming its arrow eastward.

But the storms are much more difficult to forecast, because the conditions that can lead them to form can be very subtle. And there's overall less research on these storms than on their more dramatic cousins, tornadoes. "We have to rely on situational awareness," Czarnetzki says. "Like people, sometimes you can have an exceptional storm arise from very humble origins."

**Derecho radar**

The August 10 derecho, seen in radar images here as it moved across the Midwest (times are CDT) had a distinctive curved shape on radar, like a bow poised to shoot an arrow eastward. In some places, the storm had sustained winds of about 160 kilometers per hour, comparable to the wind strength of a Category 3 hurricane.

The Aug. 10 derecho was particularly long and strong, with sustained winds in some places of up to 160 kilometers per hour (100 miles an hour). Still, such a strong derecho is not unheard of, Czarnetzki says. "It's probably every 10 years you'd see something this strong."

Whether such strong derechos might become more, or less, common due to climate change is difficult to say, however. Some anticipated effects of climate change, such as warming at the planet's surface, could increase the likelihood of more and stronger derechos by increasing atmospheric instability. But warming higher in the atmosphere, also a possible result of climate change, could similarly increase atmospheric stability, Czarnetzki says. "It's a straightforward question with an uncertain answer."

**Atlantic hurricanes**

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Hurricane Laura roared ashore in Louisiana in the early morning hours of August 27 as a Category 4 hurricane, with sustained winds of about 240 kilometers per hour (150 miles per hour). Just two days earlier, the storm had been a Category 1. But in the mere 24 hours from August 25 to August 26, the storm rapidly intensified, supercharged by warm waters in the Gulf of Mexico.

The Atlantic hurricane season is already setting several new records, with the National Oceanographic and Atmospheric Administration predicting as many as 25 named storms, the most the agency has ever anticipated (*SN*: 8/7/20).

At present, 2005 still holds the record for the most named storms to actually form in the Atlantic in a given season, at 28 (*SN*: 8/22/18). But 2020 may yet surpass that record. By August 26, 13 named storms had already formed in the Atlantic, the most ever before September.

The previous week, researchers pondered whether another highly unusual set of circumstances might be in the offing. As Laura's track shifted southward, away from Florida, tropical storm Marco appeared to be on track to enter the Gulf of Mexico right behind it. That might have induced a type of physical interaction known as a Fujiwhara effect, in which a strong storm might strengthen further as it absorbs the energy of a lesser storm. In perhaps a stroke of good luck in the midst of this string of weather extremes, Marco dissipated instead.

As Hurricane Laura approached landfall, the U.S. National Hurricane Center warned that "unsurvivable" storm surges of up to five meters could inundate the Gulf Coast in parts of Texas and Louisiana. Storm surge is the height to which the seawater level rises as a result of a storm, on top of the normal tidal level.

It's impossible to attribute the fury of any one storm to climate change, but scientists have observed a statistically significant link between warmers waters and hurricane intensity. Warm waters in the Atlantic Ocean, the result of climate change, juiced up 2017's hurricanes, including Irma and Maria, researchers have found (*SN*: 9/28/18).

And the Gulf of Mexico's bathlike waters have notably supercharged several hurricanes in recent years. In 2018, for example, Hurricane Michael intensified rapidly before slamming into the Florida panhandle (*SN*: 10/10/18). And in 2005, hurricanes Katrina and Rita did the same before making landfall (*SN*: 9/13/05).

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As for Laura, one contributing factor to its rapid intensification was a drop in wind shear as it spun through the Gulf. Wind shear, a change in the speed and/or direction of winds with height, can disrupt a storm's structure, robbing it of some of its power. But the Gulf's warmer-than-average waters, which in some locations approached 32.2° C (90° Fahrenheit), were also key to the storm's sudden strength. And, by warming the oceans, climate change is also setting the stage for supercharged storms, scientists say.

sciencenews.org, 27 August 2020

<https://www.sciencenews.org>

### Why bioplastics will not solve the world's plastics problem

2020-08-31

Coca-Cola calls it the PlantBottle — a new kind of recyclable plastic container, 30 percent of which is made from sugar cane and other plants, with the remaining 70 percent made from traditional oil-based plastic. The company says that PlantBottle packaging now accounts for nearly a third of its North American bottle volume and seven percent globally.

Does the PlantBottle mean the giant soft drink company has cracked one of the world's most serious environmental problems, the choking of the world with oil-based plastics that never completely break down and disappear? Hardly. Though companies like Coca-Cola and Pepsi are under public pressure to solve the problem of plastic pollution, they have so far been unable to find a material or method as cheap and effective as single-use plastic.

Bioplastics, which make up part of Coke's PlantBottle, have been touted as an important solution to the world's plastic pollution problem. But despite a growing push in recent years to come up with an organic plastic that satisfies product needs and, after use, becomes part of nature again, making bioplastics that are both cheap and effective has posed a major challenge.

"The concept that we could use it, throw it away, and it doesn't matter where you throw it, and it's going to safely disappear, that does not exist," said Ramani Narayan, a professor at the School of Packaging at Michigan State University. "Nobody could engineer something like that, not even nature."

**"The concept that we could use it, throw it away, and it doesn't matter where you throw it, and it's going to safely disappear, that does not exist," said Ramani Narayan, a professor at the School of Packaging at Michigan State University.**

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Instead, many experts believe the solution to plastic waste mainly lies not in developing better bioplastics, but in overhauling the world's economy to recycle far-greater quantities of plastic than currently are being reused. A just-released two-year study called Breaking the Plastic Wave by Pew Charitable Trusts and SYSTEMIQ, found that despite the efforts of industry, governments, and NGOs, the plastic problem is getting much worse.

Indeed, a recent study in the journal *Science*, authored by the researchers associated with the Pew report, estimated that some 11 million metric tons of plastic now find their way into the oceans each year — 3 million more than previous estimates. The study said that if the world continues on its current course of skyrocketing plastic consumption, the amount of plastic waste being produced will triple by 2040.

The only solution to this burgeoning problem, the Pew report concludes, is a massive \$600 billion overhaul of the world's plastic system that reuses and recycles plastic in a circular economy, along with other, smaller-scale changes, including bioplastics. If its recommendations are adopted, the Pew report says, plastic waste could be reduced by 80 percent over the next two decades.

Among the remedies proposed in the report are the elimination of plastic packaging wherever possible, substituted with paper or compostable material; designing products for effective recycling; increasing mechanical recycling; scaling up collection and recycling efforts in moderate- and low-income countries, where the vast majority of ocean plastic originates; and an end to exports of waste plastic, which would force countries where the waste is generated to come up with solutions to the plastics problem.

Marian Chertow, an expert in industrial ecology at the Yale School of the Environment, says that a key step is taking the onus off governments for recycling and instead requiring companies that use the packaging to play a lead role in its recycling and reuse.

"It's called extended producer responsibility — product take-back," says Chertow. Governments "should say, 'We can't recycle all of this stuff. We can't pay for all the costs of recycling. We have to work with you, the producer.'"

The notion of industry bearing the financial burden for recycling the materials it produces is starting to gain some traction, with companies such as Nestle Waters vowing to support moves to implement extended producer responsibility in the beverage industry.

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From the shores of the Arctic Ocean, to the beaches of the Mediterranean, to the rivers of India, plastic is accumulating in staggering quantities, especially in marine environments. The Great Pacific Garbage Patch has now grown so large that it is spread across an area four times the size of California, according to a [study](#) in the journal *Scientific Reports*. And this plastic, which eventually breaks down into nanoscale particles and is consumed by organisms from algae to whales, will never go away.

So why have bioplastics, touted as an important solution to the plastic problem, fallen far short of their promise?

Single-use plastic packaging made from oil — technically polyethylene terephthalate, or PET — is the kind most drinks and food are sold in. It is, in many ways, the perfect packaging — strong, light, versatile, clear, and inexpensive. It protects products extremely well, keeps them fresh, and can even stand up to the acid and pressurization of soft drinks without breaking down or becoming permeable over months or years.

Bioplastic needs to replicate these functions, and it does for some products. The two most commonly used bioplastics are PHA, short for polyhydroxyalkanoate, generally made from sugars that are grown from algae, and PLA, for polylactic acid, which is made from the sugar found in crops like corn and sugarcane. PLA is a tenth the cost of PHA and so is more widely used for disposable cutlery and a variety of packaging. PHA is used as a coating for the inside of paper cups and medical applications.

Neither of these bioplastics is widely used, however, because they simply don't compare to the strength and other properties of traditional plastic, and they cost substantially more. The global plastic market is worth \$1.2 trillion, and bioplastics have a market share of \$9 billion.

While both of the bioplastics now in use can be broken down by microorganisms and become part of the natural world again in a short period of time, this only happens if the plastic is collected and composted in carefully controlled, high-temperature industrial composting facilities — and there aren't many of those, especially in developing countries where the problem of plastic pollution is most severe.

If bioplastics end up in landfills, as many do, without enough oxygen to break them down, they can last for centuries and release methane, a potent greenhouse gas. If thrown into the environment, they pose threats similar to PET plastic.

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"They are basically the same as plastic and don't decompose in the way most people think they do," said Rebecca Burgess, CEO of [City to Sea](#), a UK environmental nonprofit that was formed to reduce plastic in the oceans. "They often end up as rubbish littering our streets and oceans and killing marine life. Bioplastics are a 'false solution' as they are single use and there are limited options to compost them... Reducing the amount of single-use packaging we use is the only solution."

The drawbacks of bioplastics to date haven't stopped marketers like Coca-Cola from implying the plastic pollution problem is being solved. They use the popular, if vague, terms "plant-based" or "bio-based" or "compostable," for example. "Marketing is highly abusive in this area," said Taylor Weiss, an assistant professor at Arizona State University who researches algae-based bioplastics.

Even a 100-percent plant-based bottle is not the solution it might seem. Not only can bioplastics find their way into the environment and take many years to break down, but because they are made from plants, they come with the environmental problems that large-scale agriculture causes. The sugars used to make bioplastic often come from transgenic crops sprayed with herbicides and pesticides, and these crops take land out of production that is needed to feed a growing global population. This mirrors the problems found in biofuels, which were similarly seen as an environmental solution. Experts say that using bioplastic and biofuels will greatly increase the land needed for agriculture.

And because PLA's are generally mechanically recycled — which means they are cleaned, shredded, melted down, and made into pellets to be used again — they can contaminate the waste stream of petroleum-based plastics that are chemically recycled.

On the other hand, PHAs can be made from sugars grown in algae and so there is no impact on food production. But using algae to produce bioplastic ingredients is expensive and it could take years before PHA plastics could be scaled up to a level that substantially decreases the cost.

Experts say that the challenges of introducing bioplastics on a massive scale show how hard it will be to replace the billions of plastic bottles polluting the planet.

"There isn't a silver bullet," said Simon Reddy, who directs Pew's ocean plastic program and was an author of the recent report. Instead, a variety of new approaches are needed to overhaul the current economy. "It's about designing products for recycling," he said. "Currently we

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don't do that. The information on the label about plastics is vague and unintelligible. The recyclability should be first and foremost."

In Europe about 42 percent of plastic packaging was recycled in 2017, while in the U.S. just 8.4 percent of plastic is recycled.

Some small recycled plastic successes are taking place. Evian, the spring water bottler, recently launched a bottle made from 100 percent recycled PET. The company says its goal is to become what is known as "fully circular" — to have all of its bottles made from 100 percent recycled plastic by 2025. And Coca-Cola has vowed to recycle one plastic bottle for every bottle it sells by 2030.

Deposits on plastic bottles have also helped raise recycling rates, especially in Europe, where 10 countries have implemented small deposits on plastic bottles and achieved impressive returns — including 97 percent in Norway.

Alternatives to traditional PET bottles are slowly being developed, though on a small scale. Carlsberg, the Danish beer brewer, says it has spent five years developing a paper bottle lined with bioplastic. The spirit maker Johnnie Walker says that next year it will release a plastic-free paper bottle for a limited-edition run of its whiskey.

And a leading Dutch sustainable chemistry company, Avantium, working with Coca-Cola, just announced the development of a 100-percent plant-based bottle made of PEF — polyethylene furanoate, which is produced from sugars. Avantium says its bottle is better than PET as a container for soda and other products and breaks down completely in a year in a composting facility, and in a few years in the natural environment. "It really is the next-generation material that people have been looking for," Tom van Aken, CEO of Avantium told an industry magazine.

But some skeptics say Avantium needs to publish the specifics of its claim before its technology can be considered a viable solution. And even if this plastic technology proves to be as beneficial as the company claims, the company would need to scale up production to replace PET, which would take years.

Such developments so far represent small steps compared to the growth in demand for plastic containers, especially in the developing world, which uses billions of bottles every year. Recycling traditional plastic bottles is a huge challenge for low- and moderate-income countries, many of which have virtually no recycling systems in place. As much as 95 percent of the

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plastic that is transported by rivers into the world's oceans comes from 10 rivers in Asia and Africa.

Inertia is also a factor. The massive global packaging system is still geared to use new plastic made from cheap oil, not recycled plastic, which is much more expensive. "As long as we continue to produce virgin resin, recycling will never happen," said Michigan State's Narayan. "Brand owners — Coca-Cola and Pepsi — need to say they will not sell water or juice in a bottle that does not contain recycled content, irrespective of the cost. The pop bottle of the future will still be the current PET bottle. It does a great job. But we need the ability to collect it and recycle it and recycle it. That is the future."

e360.yale.edu, 31 August 2020

<https://www.e360.yale.edu>

### Should I stop running if my knee hurts?

2020-09-01

The most common site for pain in recreational runners is the knee. For some, especially older runners, the pain can be a symptom of osteoarthritis. But does running worsen knee pain and osteoarthritis?

A study from Canada shows that many people — including health professionals — believe running might be harmful to knee joints, particularly in people with knee osteoarthritis. One in two people believes that the repetitive loading associated with running, especially frequent or long-distance running, will speed up the deterioration caused by knee osteoarthritis and shorten the time to having the knee surgically replaced with an artificial joint.

But are these fears about running supported by science? Recreational exercise does not seem to be harmful to knee cartilage. In fact, exercise is important for cartilage health — the stimulus brings nutrients to the joints. And people who exercise moderately are less likely to have knee osteoarthritis. More specifically, recreational runners have far lower rates of knee osteoarthritis than non-runners. So you could say that *not running* might be bad for your knees.

However, high-volume or high-intensity running is associated with higher rates of knee osteoarthritis compared with recreational running, suggesting that there is probably a sweet spot which doesn't involve being a couch potato or getting too competitive.

**So you could say that not running might be bad for your knees.**

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**What if you already have knee pain or osteoarthritis?**

It is not clear whether continuing to run with knee pain or osteoarthritis is bad for your knees, and many researchers around the world are exploring this question. But continuing to run, if you can, will help achieve the many health benefits of regular physical activity, including preventing at least 35 chronic diseases, such as [heart disease](#), [stroke](#), [type 2 diabetes](#) and [depression](#). In general, runners live three years longer than non-runners. And the benefits of running are independent of other things, such as [age](#), [sex](#), [weight](#), [alcohol](#) and [smoking](#). In other words, if two people regularly smoked cigarettes or drank alcohol excessively, and one of them was a runner, the runner would still live longer than the non-runner.

Running is an activity that can be done outdoors in most parts of the world and requires minimal equipment. And health benefits can be achieved with as little as [50 minutes running a week](#). During the pandemic, the fact that it can be done alone without the help of others further increases its attractiveness and ensures people can continue to participate to stay healthy.

**Three tips for managing running-related knee pain**

You can exercise safely by following [simple rules](#).

1. Reducing running volume or intensity (reduced speed, avoiding downhill) will [reduce knee loads](#) and can help reduce pain.
2. Seeking help and guidance for therapeutic exercise, such as strengthening the knee and hip muscles, from a physiotherapist or other qualified professional, can reduce knee pain related to running and other activities, including in people with [knee osteoarthritis](#).
3. Carefully consider changing your running technique with guidance from a professional. Changing your running style to a forefoot strike instead of heel strike can [reduce loads on the knees](#) and [running-related knee pain](#). However, it will increase loads on the ankle, [posing risks to injure other joints and tissues](#). Increasing running cadence (step rate) or changing the position of your trunk can also reduce loads on the knee and [may help reduce pain](#).

theconversation.com, 1 September 2020

<https://www.theconversation.com>

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**What do unconscious bias tests really reveal about racism?**

2020-08-26

YOU are biased. So am I. We all discriminate. It is both a source of concern and comfort that we don't necessarily do so deliberately and that our prejudices aren't always wilful.

If societies are to truly confront the pernicious effects of racism and prejudice, the importance of examining these biases and how they become etched into the brain is becoming increasingly clear. The death of George Floyd under the knee of a police officer in Minneapolis on 25 May shook the world to attention, but it was no isolated incident. Every day there are stories of people being treated with suspicion – or far worse – based on their skin colour while [going about their daily lives](#).

This is in spite of the fact that, [for the past 40 years](#), opinion polls show a [steady decline in racist views in the US, UK](#) and other countries. That has led some researchers to suspect that, as explicit racism has been driven underground, unconscious bias is playing a critical role. This suspicion inspired the creation of the [Implicit Association Test](#), a tool that aims to reveal unconscious biases with a few clicks of the mouse.

Unfortunately, the accuracy and reliability of this widely celebrated test isn't what it once seemed. Pinning down the nature and extent of hidden bias is proving to be extraordinarily complicated. Eradicating it is far from straightforward, too – and it turns out that some efforts to do so may [further entrench the very prejudices they are meant to uproot](#). But we are making progress, not least in understanding the processes in our brains that perpetuate bias – and what we can do to change them.

What exactly is unconscious or implicit bias? In psychological research, the label "implicit" refers to processes that aren't direct, deliberate or intentional self-assessments. When we can't retrieve a memory explicitly, we might still behave in a way that is shaped by our past experiences, for instance. The conscious mind governs deliberate actions, rational thoughts and active learning, while the unconscious carries on with processes that occur automatically or aren't available to introspection. The unconscious is a busy place: the brain is capable of processing approximately 11 million bits of information every second, but [our conscious mind can handle only 40 to 50 of them](#).

As all of this information comes in, our brains categorise it without our deliberate attention. When we process information on a more superficial

**Pinning down the nature and extent of hidden bias is proving to be extraordinarily complicated.**

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level – when we are in a hurry, tired or distracted, for example – we are more likely to rely on existing templates. Occasionally, such cognitive shortcuts can be useful, such as when we need to decide something quickly. But they can also be problematic, especially if these shortcuts were formed based on mistakes, misinterpretations, stereotypes or other biased information. When we use them, we may then be relying on and reinforcing these very mistakes and biases. When that happens with people in positions of power and authority, it can have far-reaching consequences, from discriminatory hiring practices to poorer healthcare treatment or prejudice in the legal system.

The idea that we could pin down and study implicit bias was first hinted at in 1995 when social psychologist Anthony Greenwald, then at Harvard University, and his colleagues invented the Implicit Association Test (IAT) to measure the strength of links between different concepts and words. For instance, participants would be shown black or white faces and asked to pair them with descriptors such as angry, clever, good and bad (see “How the bias test works”). This was adapted for the web in 1998 by Greenwald and fellow Harvard psychologist Mahzarin Banaji.

There have since been several adaptations of the test, measuring views on race, body type, gender and even names. The array of applications and easy online access have amplified the test’s appeal. It is hard to overstate just how influential it has been in both academic research and the public understanding of implicit bias. In his 2005 book *Blink: The power of thinking without thinking*, journalist Malcolm Gladwell summed up the prevailing view: “The IAT is more than just an abstract measure of attitudes. It’s a powerful predictor of how we act in certain kinds of spontaneous situations.”

Yet for all this, its results are inconsistent and hard to reproduce. Many studies have challenged the idea that the IAT reveals only unconscious processes. The reliability of results also appears to decline the more times you take it in a sitting.

What the IAT really measures is reaction time, based on the assumption that the speed with which we make associations reflects underlying mental processes. But everything from reflexes and physical ability to whether the user is distracted can influence this. Several studies have now shown that, for individuals, carrying an implicit attitude is only weakly linked to biased behaviour in the real world.

Part of the problem may be with how the test is used. Neuroscientist Calvin Lai at Washington University in St Louis, Missouri,

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studies implicit bias and is on the executive committee of Project Implicit, the non-profit research collaboration that studies implicit social cognition and examines the data gathered using the different versions of the IAT. He and others admit that the test is imperfect, but stress that it isn’t intended to be a one-off measure. “IAT results should be used as an educational experience for self-reflection but should not be treated as a tool for diagnosing one’s self or others,” he says. “A single administration of the race IAT tells you as much about your enduring racial attitudes as a single measure of your blood pressure tells you about your blood pressure over time: not very much.”

**The nature of bias**

But aggregated IAT results do tell us something about the nature of unconscious bias within societies. Information from Project Implicit reveals that, of the 630,000 people around the world who have taken a version of the IAT that examines associations between gender and science-related abilities, more than two-thirds correlate males more strongly with science roles and females more strongly with humanities, for instance. Test results from more than 1.8 million people in the US showed that in geographic areas where white residents show higher implicit race bias measured by a version of the IAT, there is also greater use of force by the police against black people.

**Unfortunately, the IAT is still widely perceived as a diagnostic tool. Most anti-bias courses in the US and UK begin with the test, then give the results as a score that is seldom followed up by a deeper explanation. Occasionally, training programmes give examples illustrating the impact of unconscious bias and tips for how to reduce this influence (see “Ways to tackle your prejudice”).**

Yet even with this kind of guidance, bias training is no magic wand that will cure individuals of their prejudices. It doesn’t seem to have a lasting impact on attitudes around diversity within corporations, for example. And while it appears to help reduce discriminatory behaviour by individuals for up to two weeks after attending, there is no evidence it leads to long-term change. Some kinds of training may even reinforce stereotypes, particularly if the participants are distracted or rushed.

That isn’t to say that we are without options. Advances in brain scanning techniques have helped reveal the neural underpinnings of our biases and in particular how prejudices about other groups of people activate brain areas associated with threat and fear (see “The roots of racism”). In an influential 2005 study, Mary Wheeler and Susan Fiske at Princeton

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University asked white volunteers who were in an MRI scanner to perform tasks while looking at black or white faces. They found that when the task involved thinking of the person whose face they saw as part of an out-group, rather than as an individual, the participants showed increased activity in the amygdala, the part of the brain that governs our threat response. Other brain scanning studies show greater activity in the amygdala when people view others from different ethnic backgrounds to their own.

Skin colour isn't the only way our brains can automatically categorise people. Our response to different accents may be similar. In 2014, Patricia Bestelmeyer at Bangor University in the UK and her colleagues found that when people heard accents similar to their own, there was increased activity in brain areas associated with positive emotional response; the opposite was true for different accents. "There is an increasing perception of the importance or relevance of those accents that are similar to ours," she says.

Yet the imaging revolution in bias research has also demonstrated that our brains can change with experience and environmental influences. In 2013, Eva Telzer, then at the University of Illinois, and her colleagues conducted a study of 49 children and adolescents born in Asia, Europe and the US. They showed that the difference in amygdala activity in response to faces from different races wasn't innate, but developed over a period of time.

This landmark study quashes any suggestion that we are somehow born prejudiced. What's more, Telzer and her team found that study participants with a more diverse set of peers had less of a heightened threat response in the brain when shown faces from other racial groups. That suggests simply having more contact with people from different groups can reduce the importance of race in how we respond to people and that we can change our biases.

This wasn't always a given. In social psychology there was a long-standing assumption that traces of past experiences linger on whether we want them to or not. But we now know that unconscious bias isn't as stable as previously believed. Our biases are shaped by how we are brought up, what we see around us and the media we are exposed to. Knowing we can change their influence also means we can no longer shrug them off as beyond our control.

One day we may even have a tool that helps us to reliably measure them. "There is ongoing research to develop longer or more sophisticated

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versions of the IAT or other implicit measures that are reliable enough for diagnosis," says Lai. Unfortunately, none are yet ready for public use.

We needn't wait for new tools to assess the harms of bias, though. "Your best bet for understanding inequities in your organisation is collecting data about inequities within your organisation, not taking the IAT," says Lai.

Even as efforts are under way to better measure the influence of unconscious bias, a growing number of researchers argue that we actually need to simplify this debate – to drive home that bias is bias, and whether it is unconscious or overt, whether individual prejudices shape social institutions or are shaped by them, they can cause irreparable damage. Unconscious bias is easier to ignore, but it cannot excuse discriminatory behaviour. It is important to remember that even if we cannot precisely measure our biases just yet, we can still overcome them.

[newscientist.com](https://www.newscientist.com), 26 August 2020

<https://www.newscientist.com>

### A university is offering scholarships for you to do absolutely nothing

2020-08-29

**(CNN)**How would you like to win a scholarship for doing nothing? A German university is soliciting submissions for just that, and three people will be awarded a \$1,900 stipend.

On Wednesday, The University of Fine Arts in Hamburg announced a call for applications for their «Scholarships for Doing Nothing,» between now and September 15.

"The world we are living in is driven by the belief in success, in growth, in money. This thinking was leading us into the ecological crisis -- and social injustice -- we are living in. We wanted to turn that upside down -- giving a grant not for the 'best' and for 'doing a project,' but for doing nothing," said Friedrich von Borries, a professor of design theory at the university and creator of the scholarship project.

Von Borries told CNN that applicants from all over the world and all walks of life are welcome to present their ideas.

The submission questionnaire asks applicants to think about an activity they do not want to do, how long they don't want to do it for, why it is

**The submission questionnaire asks applicants to think about an activity they do not want to do, how long they don't want to do it for, why it is important to not do the specific thing in question, and why they are the right person not to do it.**

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important to not do the specific thing in question, and why they are the right person not to do it.

The idea is that refraining from doing something may actually benefit others, who would otherwise be impacted by the negative consequences of our actions.

“We played with the term ‘doing nothing’ but we are meaning, to be more precise, ‘not doing something anymore,’” von Borries said, speaking about the conscious decision to pursue “active inactivity.”

All applications will be anonymously featured in [an upcoming exhibition](#) at Hamburg’s Museum of Art and Design called «The School of Inconsequentiality: Exercises for a Different Life,» focused on the idea of sustainability.

Three cash prize winners will be announced at the opening of the exhibition on November 5, and winners will be required to produce a report about their experience to be featured at the exhibit.

The report is not intended as a tool for accountability, but rather it should offer insights about how the winners fared in trying to refrain from doing something. “I think that doing nothing is not that easy. You can fail. Your surroundings can become aggressive ... And we would love to learn from the experience of those who will receive the grant,” said Von Borries.

The call for submissions happens in the context of a pandemic that highlighted the importance of staying home and refraining from some activities for the greater good.

“During Covid, we stopped being busy not only to protect ourselves but to protect others,” Von Borries said. “That is something I find very important and I hope we will be able to transfer this attitude into the post-Covid times,” he added.

It’s not easy to shift our mindset from being so focused on productivity and success to quite the opposite. Von Borries, who says he also struggles with being “obsessed with work,” hopes he too will learn from the applications.

“We all live everyday in contradictions between what we do, what we want to do, and what we know would be better to do. We have to learn to deal with these contradictions, instead of simply denying them,” he said.

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You can submit your applications [here](#).

edition.cnn.com, 29 August 2020

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

### How likely are you to be infected by coronavirus on a flight?

2020-08-21

Is it safe to fly with the [coronavirus](#) still circulating? That depends partly on where you are. But while hard evidence is scarce, it appears the risk of being infected with the coronavirus during a flight is relatively low.

“Overall, planes are probably safer than poorly ventilated pubs, where similar densities of people do not wear masks and talk a lot and loudly,” says Julian Tang at the University of Leicester in the UK.

It is of course [safest not to travel](#), especially if you are vulnerable. And if you have symptoms that might be coronavirus, you definitely must not travel.

Walking, cycling or travelling in your own vehicle minimises the risk of coming into contact with people who might be infected. If you use public transport, the risk depends firstly on the odds of an infected person being on the same bus, train or plane, and then the odds of them infecting you.

Travelling in South Korea, for instance, [where just 1 in about 225,000 people test positive every day](#), is inherently safer than travelling in the US, where 1 in 6500 people test positive every day. In the UK, 1 in 60,000 people are confirmed positive daily.

If you sit on a plane near someone who is infected, how likely are you to catch the virus? We don’t know for sure as there is little to go on, but some case studies offer clues.

One describes [a 5-hour flight from Singapore to China on 23 January](#), where 11 of the 325 people on board were infected by one man. Passengers were screened before boarding, but the man developed a fever during the flight and was not wearing a mask. It is not clear how transmission occurred.

However, when [an infected couple flew from China to Canada on 22 January](#), none of the other 350 passengers on the 15-hour flight were infected. Masks were worn.

**“Overall, planes are probably safer than poorly ventilated pubs, where similar densities of people do not wear masks and talk a lot and loudly,” says Julian Tang at the University of Leicester in the UK.**

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In a [document on the medical evidence for in-flight transmission](#), the International Air Transport Association (IATA), an industry body, says that when four airlines followed up with 1100 passengers confirmed to be infected after flying, just one passenger may have been infected by one of them.

It's not clear how reliable this finding is, however, as no details have been published and the IATA did not respond to queries. Nonetheless, there are reasons to think the risks are low.

Many airports check people's temperatures before they board, and airlines now disinfect planes between flights and require passengers to wear masks. The air on planes is also replaced every 3 to 5 minutes, and the air that is recirculated goes through HEPA filters that should remove almost all [droplets containing viruses](#).

"The ventilation systems on planes are very effective in reducing the overall concentration of any airborne pathogen exhaled by passengers," says Tang. The main risk may be face-to-face conversations where air can be exchanged before being pulled away – along with any conversations before or after the flight.

In the US, [the risk of infection is about 1 in 4000](#) if a flight is full, estimates Arnold Barnett at the Massachusetts Institute of Technology. If the middle seats are left empty, the risk falls to 1 in 8000.

For the UK, the equivalent risks are about 10 times lower, says Barnett. That is, there is just a 1 in 40,000 chance of infection. These are just rough estimates based on many assumptions, however.

It is not clear how travelling on trains or buses compares as their ventilation systems vary. For instance, [the air on Eurostar trains is replaced every 15 minutes](#). Eurostar did not answer when asked if its trains have HEPA filters.

In China, a study of 2334 people who travelled on high-speed trains while infected concluded [they infected 234 other passengers](#) – but there were 72,000 people who sat within three rows of those already infected, and just 234 of them got infected too.

[newscientist.com](#), 21 August 2020

<https://www.newscientist.com>

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### Solar panels are starting to die. What will we do with the megatons of toxic trash?

2020-08-13

Solar panels are an increasingly important source of renewable power that will play an essential role in fighting climate change. They are also complex pieces of technology that become big, bulky sheets of electronic waste at the end of their lives — and right now, most of the world doesn't have a plan for dealing with that.

But we'll need to develop one soon, because the solar e-waste glut is coming. By 2050, the [International Renewable Energy Agency projects](#) that up to 78 million metric tons of solar panels will have reached the end of their life, and that the world will be generating about 6 million metric tons of new solar e-waste annually. While the latter number is a small fraction of the [total e-waste humanity produces](#) each year, standard electronics recycling methods don't cut it for solar panels. Recovering the most valuable materials from one, including silver and silicon, requires bespoke recycling solutions. And if we fail to develop those solutions along with policies that support their widespread adoption, we already know what will happen.

"If we don't mandate recycling, many of the modules will go to landfill," said Arizona State University solar researcher [Meng Tao](#), who recently authored a [review paper](#) on recycling silicon solar panels, which comprise [95 percent](#) of the solar market.

Solar panels are composed of photovoltaic (PV) cells that convert sunlight to electricity. When these panels enter landfills, valuable resources go to waste. And because solar panels contain toxic materials like lead that [can leach out](#) as they break down, landfilling also creates new environmental hazards.

Most solar manufacturers claim their panels will last for about 25 years, and the world didn't start deploying solar widely until the early 2000s. As a result, a fairly small number of solar panels are being decommissioned today. [PV CYCLE](#), a nonprofit dedicated to solar panel takeback and recycling, collects several thousand tons of solar e-waste across the European Union each year, according to director Jan Clyncke. That figure includes solar panels that have reached the end of their life, but also those that were decommissioned early because they were damaged during a storm, had some sort of manufacturer defect, or got replaced with a newer, more efficient model.

**Most solar manufacturers claim their panels will last for about 25 years, and the world didn't start deploying solar widely until the early 2000s.**

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When solar panels do reach their end of their life today, they face a few possible fates. Under [E.U. law](#), producers are required to ensure their solar panels are recycled properly. In Japan, India, and Australia, recycling requirements are in the works. In the United States, it's the Wild West: With the exception of a [state law](#) in Washington, the U.S. has no solar recycling mandates whatsoever. [Voluntary, industry-led recycling efforts](#) are limited in scope. "Right now, we're pretty confident the number is around 10 percent of solar panels recycled," said Sam Vanderhoof, the CEO of [Recycle PV Solar](#), one of the only U.S. companies dedicated to PV recycling. The rest, he says, go to landfills or are exported overseas for reuse in developing countries with weak environmental protections.

Even when recycling happens, there's a lot of room for improvement. A solar panel is essentially an electronic sandwich. The filling is a thin layer of crystalline silicon cells, which are insulated and protected from the elements on both sides by sheets of polymers and glass. It's all held together in an aluminum frame. On the back of the panel, a junction box contains copper wiring that channels electricity away as it's being generated.

At a typical e-waste facility, this high-tech sandwich will be treated crudely. Recyclers often take off the panel's frame and its junction box to recover the aluminum and copper, then shred the rest of the module, including the glass, polymers, and silicon cells, which get coated in a silver electrode and soldered using tin and lead. (Because the vast majority of that mixture by weight is glass, the resultant product is considered an impure, crushed glass.) Tao and his colleagues estimate that a recycler taking apart a standard, 60-cell silicon panel can get about \$3 for the recovered aluminum, copper, and glass. Vanderhoof, meanwhile, says that the cost of recycling that panel in the U.S. is anywhere between \$12 and \$25 — after transportation costs, which "oftentimes equal the cost to recycle." At the same time, in states that allow it, it typically costs less than a dollar to dump a solar panel in a solid waste landfill.

"We believe the big blind spot in the U.S. for recycling is that the cost far exceeds the revenue," Meng said. "It's on the order of a 10-to-1 ratio."

If a solar panel's more valuable components — namely, the silicon and silver — could be separated and purified efficiently, that could improve that cost-to-revenue ratio. A small number of dedicated solar PV recyclers are trying to do this. Veolia, which runs the world's only commercial-scale silicon PV recycling plant in France, shreds and grinds up panels and then uses an optical technique to recover low-purity silicon. According

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to Vanderhoof, Recycle PV Solar initially used a "heat process and a ball mill process" that could recapture more than 90 percent of the materials present in a panel, including low-purity silver and silicon. But the company recently received some new equipment from its European partners that can do "95 plus percent recapture," he said, while separating the recaptured materials much better.

Some PV researchers want to do even better than that. In another recent review [paper](#), a team led by National Renewable Energy Laboratory scientists calls for the development of new recycling processes where all metals and minerals are recovered at high purity, with the goal of making recycling as economically viable and as environmentally beneficial as possible. As lead study author Garvin Heath explains, such processes might include using heat or chemical treatments to separate the glass from the silicon cells, followed by the application of other chemical or electrical techniques to separate and purify the silicon and various trace metals.

"What we call for is what we name a high-value, integrated recycling system," Heath told Grist. "High-value means we want to recover all the constituent materials that have value from these modules. Integrated refers to a recycling process that can go after all of these materials, and not have to cascade from one recycler to the next."

In addition to developing better recycling methods, the solar industry should be thinking about how to repurpose panels whenever possible, since used solar panels are likely to fetch a higher price than the metals and minerals inside them (and since reuse generally requires less energy than recycling). As is the case with recycling, the E.U. is out in front on this: Through its [Circular Business Models for the Solar Power Industry](#) program, the European Commission is funding a range of [demonstration projects](#) showing how solar panels from rooftops and solar farms can be repurposed, including for powering e-bike charging stations in Berlin and housing complexes in Belgium.

Recycle PV Solar also recertifies and resells good-condition panels it receives, which Vanderhoof says helps to offset the cost of recycling. However, both he and Tao are concerned that various U.S. recyclers are selling second-hand solar panels with low quality control overseas to developing countries. "And those countries typically don't have regulations for electronics waste," Tao said. "So eventually, you're dumping your problem on a poor country."

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For the solar recycling industry to grow sustainably, it will ultimately need supportive policies and regulations. The E.U. model of having producers finance the takeback and recycling of solar panels might be a good one for the U.S. to emulate. But before that's going to happen, U.S. lawmakers need to recognize that the problem exists and is only getting bigger, which is why Vanderhoof spends a great deal of time educating them.

"We need to face the fact that solar panels do fail over time, and there's a lot of them out there," he said. "And what do we do when they start to fail? It's not right throwing that responsibility on the consumer, and that's where we're at right now."

grist.org, 13 August 2020

<https://www.grist.org>

### What are the cholinesterase inhibitors, the chemical agents thought to have been used to poison Alexei Navalny?

2020-08-28

Medical tests on Alexei Navalny, the outspoken political critic of Vladimir Putin who was allegedly poisoned last week, have shed more light on his illness.

Berlin's Charité-Universitätsmedizin hospital said yesterday that Mr Navalny was being treated in intensive care and remained in a medically induced coma.

"While his condition is serious, it is not currently life-threatening," the hospital said in a statement.

Notably, the hospital said he was poisoned by «a substance from the group of cholinesterase inhibitors».

But what are these, and how can this sort of poisoning be treated?

#### From pesticides to weapons-grade chemicals

Cholinesterase inhibitors, also called anticholinesterases, are a broad group of chemical agents.

They include many everyday pesticides such as organophosphate and carbamate compounds, which the Australian Pesticides and Veterinary Medicines Authority regulates in Australia.

**In this form, these chemicals are often collectively referred to as "nerve agents".**

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They also include more exotic weapons-grade chemicals such as sarin, which was deployed in Syria, and novichok, reportedly used to poison two Russian expatriates in the UK town of Salisbury in 2018.

In this form, these chemicals are often collectively referred to as "nerve agents".

First developed in Germany in the lead-up to World War II, nerve agents are several times more potent, and therefore dangerous, than organophosphate or carbamate pesticides.

They're banned under the Chemical Weapons Convention.

These chemicals can cause harm through simple contact or inhalation, in minuscule quantities. Some reports suggest Mr Navalny was poisoned via a cup of tea, which would also be effective.

It is no exaggeration to say this group represents the most lethal chemicals humans have ever created.

#### How do they make people sick?

Cholinesterase inhibitors work by blocking an enzyme called acetylcholinesterase.

Under normal circumstances, acetylcholinesterase regulates the amount of a neurotransmitter called acetylcholine (ACh) that crosses our nerve junctions (or synapses), converting electrical signals through the body.

ACh acts mainly on the body's autonomic (involuntary) nervous system, which controls fundamental functions such as heart rate, breathing rate, salivation and digestion. It is a crucial neurotransmitter.

Left unregulated, the effect of cholinesterase inhibitors is a little bit like blocking one of the major "off-switches" of the body. You're left with all the lights turned "on" and the body quickly runs into trouble.

A rapid build-up of ACh at the nerve junctions leads to the effects we tend to see in nerve agent toxicity, including mucus secretions from the respiratory and digestive tracts, breathing problems, and muscle dysfunction.

Ultimately, death is usually a result of respiratory failure.

#### How can this poisoning be treated?

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It is possible to treat nerve agent poisoning with a combination of physical and pharmacological interventions. But it is dangerous, and difficult.

Initially, decontamination is critical. Poisoning continues as long as contact with the agent continues, and there's a risk of contamination for those providing medical care.

Significant exposure will invariably require intubation and mechanical ventilation.

The German hospital reports Mr Navalny is currently being treated with atropine.

Atropine is used to bind to and blanket ACh receptors, rendering the circulating excess of these neurotransmitters less hazardous.

### Identifying the poison

Health workers can detect whether or not someone has been exposed to harmful cholinesterase inhibitors by taking urine and blood samples.

But as time passes, and the toxin is secreted in the urine, it becomes more difficult to identify exactly what type of cholinesterase inhibitor is the culprit.

The “ghosts” of the poisoning — incapacitated acetylcholinesterase enzymes — are detectable for a longer time, but it can be very hard to link these in isolation to a specific agent.

Depending on the toxicity of the agent, how much was used, how long patients were exposed, and how they were exposed, enzyme levels can start to return to normal from several days to several weeks after exposure.

The person's health will improve, but often not back to normal.

An intermediate syndrome can last for weeks, and people affected describe this as very debilitating.

### A history of exotic poisonings

Critics of the Russian regime and their affiliates seem to have a higher than average chance of succumbing to exotic poisons, compared with the general population.

In 2004, the then-president of Ukraine, Viktor Yushchenko, was poisoned with a chemical called TCDD-dioxin, and left with facial disfigurement.

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In 2006 Alexander Litvinenko, a former FSB agent who defected to the West, was poisoned with radioactive isotope polonium-210.

The attempt on the lives of the Skripal family in Salisbury, with an agent generally assumed to be novichok, was probably the highest-profile poisoning in recent years.

In the case of Mr Navalny, it's very unlikely the specific agent used will ever be proven. But his case does share common ground with these others.

To assume all of these attempts were necessarily at the personal behest of the Russian leader is probably too long a bow to draw. But it would be reasonable to assume someone in an inner coterie was involved each time — if only to access such sophisticated weapons of assassination.

abc.net.au, 28 August 2020

<https://www.abc.net.au>

### New Guinea's mysterious singing dogs found again in the wild

2020-08-31

The haunting, plaintive wail of New Guinean singing dogs once resounded throughout the island's lush mountains and valleys. Today, with the wild population thought to have gone extinct decades ago, the songs of these secretive canines—close cousins of the Australian dingo—are heard only by zoogoers. But a new study suggests wild dogs living near a gold mine in New Guinea's highlands are in fact the same animals. If confirmed, the wild dogs could help save New Guinean singing dogs around the world.

It's not clear exactly when New Guinean singing dogs or their forebears arrived on the large Indonesian island north of Australia. The earliest evidence of dingoes down under dates to about 3500 years ago, and many archaeologists think the tan, short-haired, singing dogs—which are about the size of a border collie—showed up on New Guinea around the same time, possibly brought over by boat.

Today, between 200 and 300 New Guinean singing dogs live in zoos and sanctuaries around the world, but there hasn't been a confirmed sighting in the wild since the 1970s, when human development rapidly expanded into their habitat. Still, locals have claimed for years that they've occasionally heard the dogs' wailing.

**If confirmed, the wild dogs could help save New Guinean singing dogs around the world.**

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Enter the highland wild dog, an equally mysterious canine known only from anecdotal observations and two photographs taken in 1989 and 2012. To learn more about these canines, zoologist James McIntyre led a field expedition to the highlands of Papua on the island's western half near one of the largest gold and copper mines in the world, Grasberg Mine. On that expedition, McIntyre and colleagues, including scientists from the University of Papua, photographed and collected fecal samples from 15 highland wild dogs—which looked, acted, and howled an awful lot like New Guinean singing dogs. Two years later, the researchers managed to trap and collect blood samples from three of the animals.

The scientists sequenced the genomes of the three dogs and compared their nuclear DNA to that of 16 captive New Guinean singing dogs, 25 dingoes, and more than 1000 dogs from 161 other breeds. The highland wild dogs and New Guinean singing dogs have nearly identical genetic profiles, they report today in the *Proceedings of the National Academy of Sciences*. Both are also closely related to dingoes, and slightly more distantly to other dogs of East Asian origin like the chow chow, Akita, and shiba inu.

The New Guinean singing dogs' genome has degraded because of inbreeding, and the highland wild dogs' genome contains bits from local village dogs, but they are essentially the same dog, explains study co-author Elaine Ostrander, a geneticist at the U.S. National Human Genome Research Institute.

That would make them “a fantastic population for conservation biology,” she says. Plagued by years of inbreeding, researchers fear captive singing dogs could soon have trouble reproducing. If they could be bred with these highland dogs, it could preserve the population and reintroduce some of the genetic diversity that's been lost over years of captivity. It's also possible, she adds, that further study of the dogs' genomes could reveal how—and why—the dogs maintain a vocal repertoire that is “like nothing else we've heard in nature.”

Peter Dwyer, a zoologist at the University of Melbourne, says the work is a “very useful” study for ongoing work disentangling the relationships between dogs in New Guinea. But he cautions more evidence would be needed to conclude that New Guinea singing dogs represent a unique, archaic population of dogs, distinct from other dogs on the island. Rather, Dwyer says his own work suggests the singing dogs may be descendants

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of village dogs, some of which share many of the characteristics of the highland wild dogs living near the Grasberg mine.

sciencemag.org, 31 August 2020

<https://www.sciencemag.org>

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[Safety Concerns of Organic Ultraviolet Filters: Special Focus on Endocrine-Disrupting Properties](#)

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