

# Bulletin Board

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### ASIA PACIFIC

#### What do you need to know how to register organic water-soluble fertilizers in China?

2020-07-27

##### Definition

Organic water-soluble fertilizer is a new type of water-soluble, highly concentrated, multi-functional and nutritious fertilizer product, which is produced by extracting organic water-soluble raw materials (such as flavonoids, amino acids, alginate, sugar alcohols, chitin, sugars, organic acids, etc.) from organic waste materials after treatment, and could be compounded with macro-elements, medium elements or trace elements.

##### Features

- 1) Basing on organic nutrients, having various forms, fast fertilizer efficiency and high fertilizer efficiency utilization rate;
- 2) Having good water solubility, is suitable for fertilization methods of drop and sprinkling irrigation, and having the advantages of precise application, convenience, safety, labor saving, agricultural water saving and less pollution under integration with water and fertilizer.

##### Types of raw materials

The raw materials of organic water-soluble fertilizers currently registered in China mainly include the following types, and seaweed is the most:

- 1) Four major types of seaweeds: Brown algae (*Laminaria japonica*, *Ascophyllum nodosum*, *Undaria pinnatifida*, *Scagassum*), Blue-green algae (*Stigonema*, *Microcystis*, *Spirulina*), Green algae (*Ulva pertusa*, *Monostroma*, *Codium*), Red algae (*Porphyra*, *Gelidium amansli*, *Gracilaria*). Europe and the United States mostly use *Ascophyllum nodosum* and *Fucus vesiculosus*; South Africa uses King Algae, and China uses *Sargassum*, *Macrocystis pyrifera*, *Laminaria japonica* and *Undaria pinnatifida*;
- 2) Chitin from Shrimp shell and crab shell;
- 3) Molasses fermentation concentrate;
- 4) Low-value fish;
- 5) Other categories: Pomace, Corn steep liquor, soybean meal, etc.

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##### Basic requirements

The production enterprise must have a stable source of raw materials, the performance of the raw materials is stable, and a long-term and stable supply agreement must be signed with the raw material supplier, the origin resources should be used safely and efficiently.

From a safety perspective, for imported products that use organic degradation as raw materials, the production materials and process technology should be scientifically evaluated, and products with unclear technical characteristics and low nutrient content will be restricted.

##### Technical specification

Organic matter; pH; water-insoluble matter, can add an appropriate amount of macro elements, medium elements, and trace elements.

The following requirements should be noted:

- 1) In order to ensure the application effect of organic water-soluble fertilizers, its main component should be organic matters, and the lowest limit of organic matter content should be set.
- 2) Organic water-soluble fertilizer with biological substances such as seaweed and chitin as main raw materials, the content of organic matter should be  $\geq 5.0\%$  powder, and the content of organic matter should be  $\geq 50$  g/L aqueous solutions).
- 3) For organic water-soluble fertilizers with molasses, low-value fish, yeast liquid, soybean meal as main raw materials, the content of organic matter should be  $\geq 10.0\%$  powder, and the content of organic matter should be  $\geq 100$  g/L aqueous solutions.
- 4) The detection method of organic matter adopts the NY 1976-2010 *Water-soluble fertilizers-Determination of organic matter content*.
- 5) For organic water-soluble fertilizers with molasses fermentation concentrate as the main raw material, the content of chloride ions and sodium ions in the product should be strictly controlled and should be clearly indicated on the product label.

##### Restricted registration of organic water-soluble fertilizer products

- 1) Overseas organic water-soluble fertilizers that use animal wastes and its fermentation broth as the main raw materials, have a risk of animal diseases and harmful organisms spreading into China

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- 2) Products with complex raw materials, low production technology level, poor repeatability of product inspection results, and unstable product quality.
- 3) Products with unclear active ingredients, unclear functional mechanism, and simple blending
- 4) Products using weathered coal should apply for Water-soluble fertilizers containing humic-acids (NY 1106-2010) and using amino acids as the main raw materials should apply for Water-soluble fertilizers containing amino acids (NY 1429-2010).

REACH 24, 27 July 2020

<https://www.reach24h.com/en/news/industry-news/what-do-you-need-to-know-how-to-register-organic-water-soluble-fertilizers-in-china.html>

22 October 2019

### China: Industry welcomes swifter approvals process for cosmetic ingredients

2020-07-30

Draft measures open for consultation until 20 August

Industry has welcomed draft measures setting out detailed procedures for the registration and filing of cosmetic products and new cosmetic ingredients, which China's National Medical Products Association (NMPA) published on 21 July.

Experts have highlighted, however, that industry should pay attention to the increased requirements for post-market monitoring.

The measures will support the implementation of the country's new overarching cosmetics regulation – the Cosmetics Supervision and Administration Regulation (CSAR) – which comes into force on 1 January next year.

[Full Article](#)

Chemical Watch, 30 July 2020

<https://chemicalwatch.com/139863>

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### AMERICA

#### California requires online SDS for cosmetic and disinfectants containing hazardous ingredients

2020-07-01

Assembly Bill No. 647

CHAPTER 305

An act to add Section 6390.2 to the Labor Code, relating to occupational safety

LEGISLATIVE COUNSEL'S DIGEST

AB 647, Kalra. Hazardous substances: cosmetics: disinfectants: safety documents.

Existing law, the Hazardous Substances Information and Training Act, prescribes the rights and duties of employers who use hazardous substances, people who sell a hazardous substance to employers in California, and manufacturers who produce or sell hazardous substances. Existing law requires the Director of Industrial Relations to establish a list of hazardous substances and make the list available to manufacturers, employers, and the public. Existing law requires the manufacturer of a hazardous substance on that list to prepare and provide its direct purchasers of the hazardous substance a material safety data sheet, referred to as an MSDS, containing specified information that is current, accurate, and complete.

This bill, beginning July 1, 2020, would require an entity that manufactures or imports a hazardous substance or mixture of substances that constitutes a cosmetic or is used as a disinfectant, as defined, that is required to create a safety data sheet (SDS) for that product, to post and maintain the SDS on its internet website, as prescribed, by its brand name or other commonly known name in a manner generally accessible to the public. If a separate SDS based on color or tint exists, the bill would require the entity to post and translate each SDS. The bill would require the entity to translate the SDS into Spanish, Vietnamese, Chinese, and Korean, and other languages that the director may determine are common to the beauty care industry, and to make these translations also publicly available on its website.

**Existing law requires the Director of Industrial Relations to establish a list of hazardous substances and make the list available to manufacturers, employers, and the public.**

**Experts have highlighted, however, that industry should pay attention to the increased requirements for post-market monitoring.**

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### Keep Reading

California Legislature, 1 July 2020

[https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\\_id=201920200AB647](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB647)

### **Environmental justice leaders hail \$17 million in house bill**

2020-07-28

Funding for the EPA's environmental justice program would nearly double under the House-passed spending bill, heartening community leaders who say the funding is badly needed.

The House on Friday passed a minibus (H.R. 7608) that includes \$17 million overall for environmental justice programs at the Environmental Protection Agency. That's a significant boost from the \$9.55 million provided in the fiscal 2020 enacted budget for environmental justice activities.

The underlying Interior-Environment bill contained \$15 million for EPA's Office of Environmental Justice to enact the EJ 2020 Action Agenda. A Democratic amendment to the minibus added another another \$2 million for environmental justice programs at EPA for a total of \$17 million.

### Full Article

Bloomberg, 28 July 2020

<https://news.bloomberglaw.com/environment-and-energy/environmental-justice-leaders-hail-17-million-in-house-bill>

### **New York legislature approves bill to ban PFAS in food containers**

2020-07-26

ALBANY — In what may be the latest battlefield over potentially toxic PFAS chemicals in the environment, the state Legislature has approved a bill that would ban using the substances in food packaging.

PFAS's, or poly and perfluorooctanoic acids, are associated with health problems such as thyroid disorders and cancers. Discovery of the chemicals in the village of Hoosick Falls' water supply several years ago

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prompted emergency measures followed by a planned rebuilding of the municipal system.

There also has been a move to ban PFAS incineration amid worries about emissions such as those coming from the Cohoes' Norlite aggregate plant, which had been burning firefighting foam made with the substance.

### Full Article

Times Union, 26 July 2020

<https://www.timesunion.com/news/article/New-York-Legislature-bans-PFAS-in-food-containers-15434515.php>

### **New York State legislature bans glyphosate (Roundup) in public parks, bill goes to governor for signature**

2020-07-31

On July 22, the New York State Legislature passed Senate 6502 / Assembly 732-B — a bill that would ban the use of all glyphosate-based herbicides on state properties. The bill now awaits Governor Andrew Cuomo's signature, which would make it law effective December 31, 2021. Beyond Pesticides considers this a hopeful development in the glyphosate "saga" and has urged the governor ought to sign it. Nevertheless, such piecemeal, locality-by-locality initiatives represent mere "drops" of protection in an ocean of toxic chemical pesticides to which the U.S. public is exposed. A far more effective, protective solution is the much-needed transition from chemical-intensive agriculture and other kinds of land management to organic systems that do not use toxic pesticides.

The bill — titled "An Act to amend the environmental conservation law, in relation to prohibiting the use of glyphosate on state property" — was introduced in 2019 and sponsored by New York State Assembly Member Linda B. Rosenthal (D/WF-New York) and State Senator José Serrano. It would add a new subdivision to section 12 of the state's environmental conservation law, proscribing "any state department, agency, public benefit corporation or any pesticide applicator employed thereby as a contractor or subcontractor to apply glyphosate on state property." More than 50,000 gallons of glyphosate-based herbicides were applied in public spaces across the entirety of the state, as reported in 2019 by Bronx.com.

**The House on Friday passed a minibus (H.R. 7608) that includes \$17 million overall for environmental justice programs at the Environmental Protection Agency.**

**Beyond Pesticides considers this a hopeful development in the glyphosate "saga" and has urged the governor ought to sign it.**

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### Full Article

Beyond Pesticides, 31 July 2020

<https://beyondpesticides.org/dailynewsblog/2020/07/new-york-state-legislation-bans-glyphosate-roundup-on-public-parks/>

## EUROPE

### **Chemical recycling is essential for the EU to achieve its circular economy goals**

2020-07-20

~gChemical recycling can treat waste that can't be recycled mechanically, and therefore plays an important role in the mix of solutions to tackle the problem of plastic waste.

Today, just 15% of EU-collected plastic waste in the EU finds its way back into the EU plastic market. Chemical recycling can treat waste that can't be recycled mechanically, and therefore plays an important role in the mix of solutions to tackle the problem of plastic waste.

Mixed or contaminated plastic waste is currently burned in an incinerator, ends up in a landfill or litters our streets and waterways. Chemical recycling is the only technology available today that can change this.

Since the application of this technology to treat mixed plastic waste is relatively new and is still rapidly developing, it understandably poses legitimate questions about its carbon footprint and market viability.

This is why the chemical industry is now conducting a number of life cycle assessments looking more closely into the environmental impact. For example, one of the most recent studies has found that chemical recycling (pyrolysis) of mixed plastic waste emits 50% less CO<sub>2</sub> than incineration of the same waste. These findings confirm previous studies that showed a clear advantage of chemical recycling over incineration. Some studies also show that chemically recycled plastics have a lower carbon footprint than plastics made from fossil resources.

Chemical recycling may have an additional benefit as well; it can potentially remove the so-called "legacy chemicals" and substances of very high concern (SVHC) from plastic waste.

**~gChemical recycling can treat waste that can't be recycled mechanically, and therefore plays an important role in the mix of solutions to tackle the problem of plastic waste.**

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The chemical industry is committed to further improving this technology through its research and development efforts. We also believe that the actions by the Circular Plastic Alliance platform and similar initiative will create a more dynamic market for recycled plastic, which will also increase demand in chemical recycling. This why it is important for chemical recycling to stay part of the EU's innovation agenda and benefit from Green Recovery investments.

Cefic, 20 July 2020

<https://cefic.org/media-corner/newsroom/chemical-recycling-is-essential-for-the-eu-to-achieve-its-circular-economy-goals/>

## INTERNATIONAL

### **One in three children have unacceptably high lead levels, study says**

2020-07-29

"Children around the world are being poisoned by lead on a massive and previously unrecognized scale," according to the study, a collaboration of UNICEF and Pure Earth, an advocacy group.

Lead contamination has long been recognized as a health hazard, particularly for the young. But a new study asserts that the extent of the problem is far bigger than previously thought, with one in three children worldwide — about 800 million in all — threatened by unacceptably high lead levels in their blood.

The ubiquity of lead — in dust and fumes from smelters and fires, vehicle batteries, old peeling paint, old water pipes, electronics junkyards, and even cosmetics and lead-infused spices — represents an enormous and understated risk to the mental and physical development of a generation of children, according to the study, released late Wednesday.

The danger is particularly acute in poor and middle-income countries where industrial pollution safeguards are poorly enforced or nonexistent.

### Full Article

New York Times, 29 July 2020

<https://www.nytimes.com/2020/07/29/world/americas/lead-poisoning-children.html?action=click&module=Latest&pgtype=Homepage>

**Lead contamination has long been recognized as a health hazard, particularly for the young.**

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### ZDHC rolls out Supplier to Zero initiative

2020-07-27

Previously known as the 'Facility Leader' programme, the ZDHC has now rolled out its new 'Supplier to Zero' initiative in a bid to boost chemical management within textile supplier factories – including those that are currently off the radar.

It will be launched in three phases starting with 'foundational', then 'progressive' and finally next year with the 'aspirational' level. Its main aim is to provide practical implementation guidance for improvement at textile mills based on the existing ZDHC chemical management framework.

The foundational level is a self-assessment and verification process and is designed to on-board as many new supplier facilities as possible. But the ZDHC is also looking to include Oeko-tex Step, bluesign, BEPI (by Amfori) as well as the Higg Facilities Environmental Module (FEM) to demonstrate compliance to certain parameters when it comes to the highest 'aspirational' level of compliance.

The new programme is intended to provide industry guidance only – and won't be an independent standard.

"The supplier to zero programme is not meant to be an audit programme," Klaas Nuttbohm from the ZDHC Implementation Hub told Ecotextile News. "It's meant to be about capacity building and is a way to help textile mills to demonstrate their leadership in chemical management."

Ecotextile, 27 July 2020

<https://www.ecotextile.com/2020072726425/dyes-chemicals-news/zdhc-rolls-out-supplier-to-zero-initiative.html>

**Its main aim is to provide practical implementation guidance for improvement at textile mills based on the existing ZDHC chemical management framework.**

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## REACH Update

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### New EU reporting requirements for substances of Very High Concern

2020-07-14

Manufacturers of articles entering European Union Member States will need to report Substances of Very High Concern to a new European Chemicals Agency database by January 5, 2021. Here's what you need to know.

Previous articles in *Electronic Design* have highlighted the need for specific usages of lead in electronic components, options for materials containing halogens and phthalates, and 2015 and 2018 updates on how supply chains can declare environmental data using the IPC-1752A standard. Here we focus on EU REACH (Registration, Evaluation and Authorisation, of Chemicals), a Regulation of the European Commission. It includes requirements for industry to communicate information to customers about the REACH Candidate List of Substances of Very High Concern (SVHC) published by the European Chemicals Agency (ECHA).

[Full Article](#)

Electronic Design, 14 July 2020

<https://www.electronicdesign.com/industrial-automation/article/21136628/new-eu-reporting-requirements-for-substances-of-very-high-concern>

### New round of exemptions in Europe could prevent cliff-edge for disinfectants

2020-07-29

Alternative to official derogation extension procedure

Exemptions from EU legal requirements for disinfectants, which have been introduced amid the Covid-19 crisis, could be adopted anew to avoid a cliff-edge when they expire, a legal expert has suggested.

Europe has been coping with the surging demand for hand and surface sanitisers by exempting some products from the usual legal requirements of the EU's biocidal products Regulation (BPR).

The derogations are made under a clause in Article 55 of the BPR and last for a maximum of 180 days. While EU member states have implemented them at different times, the majority will expire in September.

**Here we focus on EU REACH (Registration, Evaluation and Authorisation, of Chemicals), a Regulation of the European Commission.**

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[Full Article](#)

Chemical Watch, 29 July 2020

<https://chemicalwatch.com/139343>

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## Janet's Corner

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### Arctic Strip Club

2020-08-07



<http://unearthedcomics.com/comics/the-arctic/>

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## Hazard Alert

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### Carbon Tetrachloride

2020-06-19

Carbon tetrachloride is a clear, colourless liquid. It has a sweet, heavy odour, and is non-flammable. It is also called by other names, including: carbon chloride, benziform, perchloromethane, methane tetrachloride, and tetrachloroethane. Carbon tetrachloride's chemical formula is  $\text{CCl}_4$ . [1,2,3]

#### USES [1,2,3]

Carbon tetrachloride is used across various industries. In the past, it was used as a solvent in oils, lacquers, varnishes, rubber waxes, resins, and fats. It was also used as a grain fumigant, and in the production of refrigeration fluid and propellants for aerosol cans. It was banned due for consumers due to its toxic effects. It is now only used in industrial manufacturing, and can also be found in fire extinguishers made before 1970.

#### ROUTES OF EXPOSURE [3]

- People can be exposed to the chemical through contaminated groundwater, where it has leached in.
- It could also be present in the air, after being evaporated.
- Sources of carbon tetrachloride include cleaning agents used in the home.

#### HEALTH EFFECTS

Carbon tetrachloride poisoning affects a range of systems, including the nervous system.

#### Acute Effects [3,4]

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

- Acute exposure to the chemical can result in damage to the liver and kidneys, including a swollen a swollen and tender liver, and nephritis, nephrosis, and proteinuria in the kidneys.
- Exposure to carbon tetrachloride can result in CNS depression.
- CNS depression can also be accompanied by nausea and vomiting.
- Animal testing has shown that acute exposure of carbon tetrachloride results in low toxicity from inhalation, low-to-moderate toxicity from ingestion, and moderate toxicity from dermal exposure

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### Chronic Effects [2,3]

Carbon tetrachloride is toxic to multiple body systems. Long-term exposure to the chemical can result in liver and kidney damage. It can also result in nerve damage, weight loss, tiredness, confusion, digestive disorders, and loss of colour vision. Carbon tetrachloride has been found to cause liver cancer in laboratory animals.

#### SAFETY

##### First Aid Measures [6]

- Ingestion: DO NOT INDUCE VOMITING. If the victim is conscious, you can induce vomiting. Immediately contact a medical professional.
- Skin contact: Wipe affected area/s with a dry, clean cloth. Remove all contaminated clothing, footwear and accessories. Rinse victim with lukewarm water until advised to stop by the poisons centre. Contact a doctor immediately.
- Eye contact: Immediately rinse eyes for 15-20 minutes with gently flowing lukewarm water. Hold the victim's eyelids open to ensure they are thoroughly flushed. Contact a medical professional immediately.
- 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 [6]

- Engineering controls: Emergency eyewash fountains and safety showers should be accessible in the immediate area of the potential exposure. Ensure there is adequate ventilation. Use a local exhaust ventilation to limit the amount of carbon tetrachloride in the air.
- Personal protection: Safety glasses, protective and dustproof clothing, gloves (PE/E/EVAL/PE; VITON; PVA), an apron and an appropriate mask/respirator. For carbon tetrachloride, a Type A filter (with sufficient capacity) is appropriate. For specifications regarding other PPE, Follow the guidelines set in your jurisdiction.

**Carbon tetrachloride is a clear, colourless liquid.**

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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 carbon tetrachloride of 10ppm.

#### Australia [7]

Safe Work Australia has set an 8-hour time TWA for carbon tetrachloride of 1ppm, to protect for hepatotoxicity in exposed workers.

### REFERENCES

1. <https://pubchem.ncbi.nlm.nih.gov/compound/Carbon-tetrachloride>
2. <https://www.dhs.wisconsin.gov/chemical/carbontet.htm>
3. <https://www.epa.gov/sites/production/files/2016-09/documents/carbon-tetrachloride.pdf>
4. <https://www.sciencedirect.com/topics/chemical-engineering/carbon-tetrachloride>
5. <http://datasheets.scbt.com/sc-239479.pdf>
6. <https://www.osha.gov/dsg/annotated-pels/tablez-2.html>
7. <https://engage.swa.gov.au/50013/documents/117894>

# Bulletin Board

## Gossip

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### Global warming is driving polar bears toward extinction, researchers say

2020-07-20

Polar bears could become nearly extinct by the end of the century as a result of shrinking sea ice in the Arctic if global warming continues unabated, scientists said Monday.

Nearly all of the 19 subpopulations of polar bears, from the Beaufort Sea off Alaska to the Siberian Arctic, would face being wiped out because the loss of sea ice would force the animals onto land and away from their food supplies for longer periods, the researchers said. Prolonged fasting, and reduced nursing of cubs by mothers, would lead to rapid declines in reproduction and survival.

“There is very little chance that polar bears would persist anywhere in the world, except perhaps in the very high Arctic in one small subpopulation” if greenhouse-gas emissions continue at so-called business-as-usual levels, said Peter K. Molnar, a researcher at the University of Toronto Scarborough and lead author of the study, which was published Monday in the journal Nature Climate Change.

Even if emissions were reduced to more moderate levels, “we still are unfortunately going to lose some, especially some of the southernmost populations, to sea-ice loss,” Dr. Molnar said.

The fate of polar bears has long been a flash point in the debate over human-caused climate change, used by scientists and environmentalists as well as deniers in their arguments.

By rough estimates there are about 25,000 polar bears in the Arctic. Their main habitat is sea ice, where they hunt seals by waiting for them to surface at holes in the ice. In some areas the bears remain on the ice year round, but in others the melting in spring and summer forces them to come ashore.

“You need the sea ice to capture your food,” Dr. Molnar said. “There’s not enough food on land to sustain a polar bear population.” But bears can fast for months, surviving on the energy from the fat they’ve built up thanks to their seal diet.

Arctic sea ice grows in the winter and melts and retreats in spring and summer. As the region has warmed rapidly in recent decades, ice extent in summer has declined by about 13 percent per decade compared to the 1981-2010 average. Some parts of the Arctic that previously had ice year-

**The fate of polar bears has long been a flash point in the debate over human-caused climate change, used by scientists and environmentalists as well as deniers in their arguments.**

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round now have ice-free periods in summer. Other parts are now free of ice for a longer portion of the year than in the past.

Dr. Molnar and his colleagues looked at 13 of the subpopulations representing about 80 percent of the total bear population. They calculated the bears' energy requirements in order to determine how long they could survive — or, in the case of females, survive and nurse their cubs — while fasting.

Combining that with climate-model projections of ice-free days to 2100 if present rates of warming continue, they determined that, for almost all of the subgroups, the time that the animals would be forced to fast would eventually exceed the time that they are capable of fasting.

In short, the animals would starve.

"There's going to be a time point when you run out of energy," Dr. Molnar said.

Compounding the problem is that a longer fasting time also means a shorter feeding period. "Not only do the bears have to fast for longer and need more energy to get through this, they also have a harder time to accumulate this energy," he said.

While fasting, bears move as little as possible to conserve energy. But sea-ice loss and population declines create new problems — having to expend more energy searching for a mate, for example — that could further affect survival.

Even under more modest warming projections, in which greenhouse gas emissions peak by 2040 and then begin to decline, many of the subgroups would still be wiped out, the research showed.

Over the years, polar bears have become a symbol both for those who argue that urgent action on global warming is needed and for those who claim that climate change is not happening or, at best, that the issue is overblown.

Groups including the Cato Institute, a libertarian research organization that challenges aspects of climate change, have called concerns about the bears unwarranted, arguing that some research shows that the animals have survived repeated warm periods. But scientists say during earlier warm periods the bears probably had significant alternative food sources, notably whales, that they do not have today.

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Poignant images of bears on isolated ice floes or roaming land in search of food have been used by conservation groups and others to showcase the need for action to reduce warming. Occasionally, though, these images have been shown to be not what they seem.

After a video of an emaciated bear picking through garbage cans in the Canadian Arctic was posted online by National Geographic in 2017, the magazine acknowledged that the bear's condition might not be related to climate change. Scientists had pointed out that there was no way of knowing what was wrong with the bear; it might have been sick or very old.

The new research did not include projections in which emissions were reduced drastically, said Cecilia M. Bitz, an atmospheric scientist at the University of Washington and an author of the study. The researchers needed to be able to determine, as precisely as possible, the periods when sea ice would be gone from a particular region. "If we had wanted to look at many models we wouldn't have been able to do that," Dr. Bitz said.

Andrew Derocher, a polar bear researcher at the University of Alberta who was not involved in the study, said the findings "are very consistent with what we're seeing" from, for instance, monitoring the animals in the wild. "The study shows clearly that polar bears are going to do better with less warming," he added. "But no matter which scenario you look at, there are serious concerns about conservation of the species."

Of the 19 subpopulations, little is known about some of them, particularly those in the Russian Arctic. Of subpopulations that have been studied, some — generally those in areas with less ice loss — have shown little population decline so far. But others, notably in the southern Beaufort Sea off northeastern Alaska, and in the western Hudson Bay in Canada, have been severely affected by loss of sea ice.

One analysis found that the Southern Beaufort Sea subpopulation declined by 40 percent, to about 900 bears, in the first decade of this century.

Dr. Derocher said one drawback with studies like these is that, while they can show the long-term trends, "it becomes very difficult to model what is happening from year to year."

Polar bear populations can be very susceptible to drastic year-to-year changes in conditions, he said. "One of the big conservation challenges is

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that one or two bad years can take a population that is healthy and push it to really low levels.”

nytimes.com, 20 July 2020

<https://www.nytimes.com>

### Plastics and pesticides: Health impacts of synthetic chemicals in US products doubled in last 5 years, study finds

2020-07-22

The proof is piling up: Many synthetic chemicals can harm your health and that of your children.

Evidence has doubled in the last five years about the negative impact on our health of endocrine-disrupting chemicals in plastics, pesticides, flame retardants and other merchandise, according to a new review of recent literature.

“It’s a global problem. These are chemicals used in consumer products all across the world,” said senior author Dr. Leonardo Trasande, chief of environmental pediatrics at NYU Langone.

The new review, published Tuesday in The Lancet Diabetes and Endocrinology journal, lists recent studies that have linked endocrine-disrupting chemicals with weight gain in women and polycystic ovary syndrome, a significant cause of infertility. These chemicals have also played a role in semen damage and prostate cancer in men, along with a host of other health concerns.

In January, Trasande and his colleagues compared early life exposures to lead to studies on the exposure of fetuses in the womb to pesticides, the methylmercury found in fish and flame retardants called polybrominated diphenyl ethers, or PBDE.

PBDE flame retardants, the study found, are the “greatest contributor to intellectual disability” in children, resulting in a total loss of “162 million IQ points and over 738,000 cases of intellectual disability.”

There’s also the health care costs of such exposure, Trasande said. The same study estimated the health costs of endocrine-disrupting chemicals in the United States at \$340 billion a year. In Europe it was markedly less, some €163 billion (US \$187 billion).

**“It’s a global problem. These are chemicals used in consumer products all across the world,”**

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This “explosion of evidence” over the last five years proves current regulations in the US are inadequate to protect citizens from the dangers of endocrine-disrupting chemicals, said Trasande, a leading expert in childhood environmental exposures.

And while Europe leads the US in bans on pesticides and minimizing human exposure, there is still much to be done there and around the world, according to a second analysis also published Tuesday in The Lancet.

“This scientific issue has matured, accumulated substantial and consistent scientific evidence, and repeatedly shown that ‘chemicals of concern’ and their replacements have many if not the same effects on human health,” Trasande said.

“That’s why we are calling for an international agency to do research in endocrine disruption,” Trasande added, suggesting it could be modeled after the International Agency for Research on Cancer.

The American Chemistry Council, which represents US chemical, plastics and chlorine industries, said the term “endocrine disruptor” was “widely misused,” and provided the following statement:

“To stay below ranges of exposure determined to be safe, consumers should read product labels closely and follow directions carefully. Some exposures will produce no response at all, while others may bring about temporary responses to which the body can naturally adjust and maintain its normal function. The primary focus should be on preventing over-exposures so that any potential health risks can be avoided.”

A chemical revolution

“I want to say one word to you. Just one word,” said party guest Mr. McGuire to Dustin Hoffman’s character Benjamin Braddock in the 1967 movie classic “Mrs. Robinson.”

“Plastics.”

Today we can add a host of other chemical discoveries to the growing list of products that have made Western life easier, cleaner and supposedly safer.

But as our use of these products grew, science learned of a flip side: Many of these chemicals can leach into our air, water and soil, and ultimately into our bodies. There they can significantly disrupt how our endocrine

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system -- our hormones -- regulate mood, sex and tissue function, growth, metabolism and more.

Some five years ago, the [World Health Organization](#) and United Nations reported on 15 ways that chemicals used in plastics, pesticides and flame retardants could affect babies from the womb to adulthood, including:

- IQ loss and intellectual disability
- Autism and attention-deficit disorder
- Childhood and adult obesity
- Low testosterone, male infertility and testicular dysfunction
- Endometriosis and fibroids in women.

The new analysis published Tuesday now adds another 17 such health impacts to the list and broadens the number of known chemicals involved. The review found evidence is particularly strong for a link between perfluoroalkyl and polyfluoroalkyl substances, or PFAS. Among the conditions PFAS chemicals have been tied in recent research are:

- Impaired glucose tolerance
- Gestational diabetes and reduced birth weight in babies
- Reduced semen quality
- Child and adult obesity
- Polycystic ovarian syndrome and endometriosis
- Breast cancer

Other plastics and pesticides are linked to adult diabetes, prematurity, reduced anogenital distance in boys, reduced semen quality and prostate cancer. An even stronger connection between insecticides, plastics and flame retardants and cognitive deficits and attention-deficit disorder in children has been shown by newer studies.

PFAS do not degrade

One of the problems is that as soon as science identifies a potential chemical hazard and it is removed, industry creates another. If they are closely tied to the originals, the new chemicals can produce very similar health risks.

Take PFAS, for example, which are used to make nonstick cookware, stain-resistant clothes, infection-resistant surgical gowns and drapes, cell phones, semi-conductors, commercial aircraft and low-emissions vehicles.

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PFAS are made up of a chain of linked carbon and fluorine atoms, which do not degrade in the environment.

"In fact, scientists are unable to estimate an environmental half-life for PFAS, which is the amount of time it takes 50% of the chemical to disappear," the [National Institute of Environmental Health Sciences](#) wrote.

While two of the most ubiquitous PFAS -- perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) -- were removed from consumer products in the US in the early 2000s, the industry has spawned many more: More than 4,700 types of PFAS [existed in 2018](#), a number that rises as industry invents more new forms.

PFAS have been detected in the blood of 97% of Americans, one 2015 report by the [US Centers for Disease Control and Prevention](#) found.

What to do?

"It's not hopeless," Trasande said. "There are safe and simple steps families can take in their daily lives to limit exposure."

Many environmental advocacy groups have clear, simple suggestions on their websites for how to reduce you and your family's exposure to endocrine-disrupting chemicals.

Take PFAS, for example. The newest category of chemicals for which the science is clocking human health effects are found in nonstick cookware, oil and water-resistant clothing, stain-resistant furniture, carpet, luggage and clothing, greasy or oily packaged fast foods and microwave popcorn, personal-care products made with Teflon™ and ingredients that include the words "fluoro" or "perfluoro."

"Avoiding the purchasing and use of those products can potentially also reduce exposure," Trasande said. "Use stainless steel or cast iron as an alternative to non-stick. Avoiding canned food will lower BPA exposure; choose glass and products packaged in glass instead. Avoid microwaving and machine dishwashing plastics of any kind.

"When it comes to flame retardants, recirculating the air and using a wet mop is an effective way to suck up that persistent dust that accumulated in homes from these products," he said. "None of the steps I've described

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break the bank. They don't require a PhD in chemistry. People can make an enormous impact on this problem, so one cannot lose hope."

edition.cnn.com, 22 July 2020

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

### Most sharks have consumed plastics, study finds

2020-07-22

Microplastics and synthetic microfibres from clothing have been found for the first time in the guts of sharks that live off the UK coast.

Scientists examined the stomachs and intestines of 46 seabed-dwelling sharks that had been caught as bycatch by Penzance-based hake fishing trawlers.

They found that 67% of the sharks examined contained microplastics or other manmade fibres commonly found in textiles. A total of 379 particles were found.

Kristian Parton, of the University of Exeter and lead author of the study published in the journal *Scientific Reports*, said the findings highlighted "the ubiquitous nature of plastic pollution".

"We were shocked that the overwhelming majority (95%) of contaminants identified were microfibres from fishing lines and nets for example, or synthetic cellulose that's used to make viscose, rayon and disposable facemasks," he said. "Having this baseline is so important to see how this changes over time for UK shark species and for future comparisons globally."

Microfibres reach the sea in a multitude of ways including the breakdown of large plastic pieces, fibres shed from car tyres or the washing of synthetic fabrics.

"Once these tiny fragments flow into our rivers and consequently our oceans, some float on the surface or within the water column while others sink to the seabed where these sharks live," Parton said. "Fibres could be ingested when the sharks eat shore crabs or squat lobsters or directly through the sediment on the seabed, as they're suction feeders."

The impact of plastic pollution on sharks is understudied, Parton said. "Most research has focused on whales, turtles, dolphins and seals up until now. This study helps build a clearer picture of how plastic pollution

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affects sharks, but also raises further questions: if microplastics affect the flesh of these sharks, humans could ultimately consume these fibres."

Dr Laura Foster, head of clean seas at the Marine Conservation Society, said: "This new research is another reminder that plastic pollution directly affects marine life in UK oceans. Tiny microfibres are less visible than a plastic bottle but we need to make more of a connection between the sea and what we do in our everyday lives, including the clothes we wear and put in the wash. It all becomes part of a soup of ocean plastic."

theguardian.com, 22 July 2020

<https://www.theguardian.com>

### UK could eliminate the coronavirus but it might do more harm than good

2020-07-22

BECOMING a covid-19-free zone sounds like the ultimate goal for any nation. Several countries around the world have come pretty close and, according to a group of independent scientists, the UK could join them. The group says that, as an island nation, the UK could introduce specific measures over the next year and follow in the footsteps of other island success stories, such as Iceland, Taiwan and New Zealand.

But closer scrutiny reveals that no country has truly eliminated the coronavirus from its shores and that doing so would mean making such large sacrifices in other areas of public well-being that it might not be worth it.

Earlier this month, Independent SAGE – a self-appointed group of scientists that provides advice with the intention of guiding UK government policy on the coronavirus – published a report recommending that the UK aims for zero reported cases, known as elimination, within the next 12 months.

"Achieving elimination would allow all social distancing measures to be lifted, schools to be fully open, the hospitality and entertainment industries to reopen fully, revitalisation of the economy and a sense of much needed normality for the population," the report said.

All the researchers *New Scientist* contacted agreed that elimination is a worthy goal. Most say it is theoretically possible for many countries, including the UK, to rid themselves of the virus even without a vaccine.

**Most say it is theoretically possible for many countries, including the UK, to rid themselves of the virus even without a vaccine.**

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Success would require tough measures, however. The steps suggested in the Independent SAGE report are familiar ones. They include boosting test, trace and isolate programmes, maintaining lockdown policies and strictly restricting travel.

Such measures would be a departure from the current phased return to normal life proposed by the UK government. It recently advised people to return to office working and will soon offer discounts on restaurant meals to encourage dining out. Recent figures suggest England's test and trace programme is only reaching about 80 per cent of infected people's contacts, and it is unclear how many of those told to isolate are doing so.

Tight restrictions on travel and border control would have costs for business, tourism and the broader economy.

The steps needed to move to elimination would have other costs. "It's really difficult to know [what the goal should be]," says Kathleen O'Reilly at the London School of Hygiene & Tropical Medicine. "It's all about balancing what's feasible, what resources you have available and what the disadvantages are with putting your resources into one disease."

Even those countries that have come the closest to reaching elimination are now in a constant battle to keep things that way. New Zealand was tentatively described as "virus free" early in June, when all restrictions except tight border controls were lifted. But the country has been reporting small numbers of new cases of covid-19 on a near-daily basis for the past month. As of 21 July, the Ministry of Health reports 27 active cases in managed isolation and quarantine. More individuals there could have symptomless infections, says Rajiv Chowdhury at the University of Cambridge. Scotland looked like it was close to elimination at the end of June, but it is still seeing a number of new daily cases.

Elimination is worth aiming for if all we want to do is put an end to covid-19, says O'Reilly. But lockdown has already significantly affected other areas of healthcare provision. In the UK, elective medical procedures have been delayed, cancer screening has been put on hold and thousands of people have avoided seeking care for serious health issues, including for heart attack symptoms.

The balance is an even greater challenge in countries with more limited resources. Those that were well on the way to eliminating polio and measles via widespread vaccination efforts, for instance, have had significant setbacks due to the diversion of healthcare

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resources during the coronavirus pandemic. "Polio virus is now spreading more, certainly in some African populations and in Pakistan," says O'Reilly.

Given these difficulties, some scientists are proposing an alternative approach: eliminating the coronavirus as a public health concern. In practice, this would mean there are so few cases that people would be unlikely to come into contact with an infected person while on an outing or visiting a restaurant, says O'Reilly. But how this relates to actual case numbers is unclear.

The Independent SAGE group suggests that having one case per million people in a population could be used to define having the coronavirus "under control", but group member Gabriel Scally admits that this figure isn't based on hard evidence about how the virus spreads.

Even this goal would mean significant, prolonged changes to behaviour in terms of social distancing, personal hygiene and mask wearing. "From what I've seen so far, I'm not hopeful," says Chowdhury.

Eradication – having zero global cases of the virus – is an even bigger challenge. We have only ever eradicated one human disease, smallpox. That came about through a massive global effort, helped by a very effective vaccine. It was also much easier to see who was infected with the smallpox virus. For now, eradication of the coronavirus seems impossible. Even if a vaccine were developed, we don't yet know how effective it would be or how long its effects might last.

Attempts to eliminate – or at least significantly lower – cases in one nation must also consider the global picture. "We have to tackle this as a world issue," says Stephen Griffin at the University of Leeds, UK. This is why the US government's decision to pull out of the World Health Organization is so "unproductive", he says.

"We have to act together," says Griffin. "If we don't, we're going to have real trouble for the foreseeable future."

newscientist.com, 22 July 2020

<https://www.newscientist.com>

### The struggles of sustainable farming

2020-07-23

**MAYBE IT TAKES** a catastrophic event to change the way that consumers relate to their desires. In Canada, we have no collective memory of food-

**Big-store grocery shopping is a hard habit to break.**

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supply shortages, and most of us have a minimal relationship with the land on which our food is grown. The majority shops in large grocery chain stores, where supplies are brought in from a food depot. We do not know the farmers growing our food, and we do not know their farms. A large portion of what we eat is shipped to us from far away. Because of this, we have lost a sense of seasonal eating, of flavour, and of the labour that goes into producing our food.

Big-store grocery shopping is a hard habit to break. For one thing, it is convenient: you can buy most everything in one spot. And, for another, it's often the cheapest, since these chains are able to buy in bulk. This type of purchasing has hidden costs, though. Hold up that inexpensive head of lettuce in your mind's eye and consider the cost of the seed, the price of the hoops under which it is grown, the chemicals used to feed it and kill pests, the electrical expense of heating and cooling its environment, the extractive cost of watering it, the cost of finding, transporting, housing, and paying the seasonal worker who tends and harvests it, and the fuel and other transport expenses of trucking it from the south to a food terminal in Canada. Consider the environmental damage the runoff from these fertilizers and pesticides causes. Consider that the seasonal workers are doing skilled and exhausting labour for little pay, often far from home. Then consider that the grocery chain has also marked up that produce. Of this, Lauren Nurse, of Small Spade Farm, near Stirling, Ontario, says: "We can't continue to expect to pay \$1 for lettuce. Somebody is being exploited under that system, and certainly the environment is being exploited."

This grocery-chain model has also been demonstrably compromised in the face of **COVID-19**. Items that we have taken for granted are not always in stock: yeast and toilet paper, but also, anecdotally, fruit and vegetables and specific cuts of meat. We are seeing long lineups and wait times to enter stores. We are experiencing the strange reality of physical distancing as we skirt one another in the aisles. For some of us, this is the first time we have had to think about where the food we buy comes from at all.

The problem is complex. Canada's food-supply system depends on a cohort of migrant workers to seed, weed, and harvest its labour-intensive produce. Because of the pandemic, the Seasonal Agricultural Workers Program (**SAWP**), run federally, will be necessarily curtailed. Mandatory fourteen-day quarantines, complex sanitation measures within current housing setups, and travel logistics mean fewer workers are making it here this year, and farmers are spending more to support them. According to the **CBC**, "Ontario employs up to 20,000 migrant workers a year to perform

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farm work throughout the growing season. The number nationwide is close to 60,000." This is a workforce without which, the Ontario Fruit and Vegetable Growers' Association claims, "domestic food production will be impossible or significantly limited."

If the pandemic brought us news of the fragility of Canada's food chain, it was not a revelation to small-scale, sustainable farmers. Organic farms in Canada, which number over 7,200 according to data compiled in 2018 by the Canada Organic Trade Association, are often helmed by individuals working small acreages who strive to protect both local food supplies and the environment.

In the past, their message has largely been ignored. It's easy to see why when you take into consideration that organic farms represent about 1.5 percent of the total land being farmed in Canada—a number that does not include other sustainable farms that do not have or cannot afford to apply for organic certification. But, now that we are, in fact, experiencing cascading events due to **COVID-19**, we might just be ready to pay attention.

**SMALL-SCALE**, sustainable farmers are mostly shut out of the large food-supply chain model—major grocery chains don't bother with their relatively low volumes—and so they have long had to find ways to directly vend their produce to consumers. Bringing food from the countryside where it is grown into the city, in the hopes of selling it to urban consumers, might sound like an obvious fix. And it is true that, in the past twenty years, farmers' markets have sprung up in many city neighbourhoods. But, as consumers, our perception of markets seems at odds with what farmers tell me of their experience. Farmers' markets are great for community building, they say, but have unpredictable results for the farmers themselves. When it rains, customers stay home. In the height of growing season, attendance declines as folks are away at cottages and on vacations. Local farmers toil without the benefit of most of the direct farm subsidies that used to be available and, as a group, receive fewer subsidies now than large operations do, meanwhile incurring greater challenges getting their food to market.

Part of the problem, too, is consumer education. For many years, Thomasburg's Earth Haven Farm, farmed biodynamically by Kathryn Aunger and her son, Aric Aguonie, has been doing community-educational outreach through its Earth Haven Learning Centre initiative. "I grew up a Native not knowing how to be Native," Aguonie says; he came to farming as a way to reconnect with his roots. He is frustrated by

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the uphill battle he experiences as he tries to educate people about local food production with regard to planting zones and growing seasons. In the current system of food supply, we are encouraged to make decisions based on criteria made for us by the supply chain—criteria that have to do less with our health and the health of the environment than with the demands of big-box capitalism. In an ideal local food supply, Nurse points out, “Mrs. Peabody doesn’t expect bananas out of season or from an Ontario vendor. We move to a more seasonal model.” Agonie puts this more baldly: “If you have the word *sale* above the pile of whatever’s underneath the word *sale*, they’re gonna get that.”

While farmer’s markets can provide some outreach in terms of education about food supply, many small farmers have developed Community Share Agriculture (**CSA**) programs as a way to market their products and their messages about sustainable agriculture. **CSA** is a system in which consumers buy shares in the production of a given farm, the bounty of which is then divided up over the season in food boxes delivered to the shareholders. This means that, in the early season, when crops are just coming up, the consumer might receive a small portion while, later in the season, they get a box that is overflowing with fresh produce. It’s a system that is vital for small operators because it provides cash flow early in the year, which in turn allows for seed and animal purchases ahead of growing season, when income sources for the farmer are otherwise scarce. It also cuts out intermediate retailers like food-box aggregators (small operations that put together food boxes from a variety of local and sometimes imported sources but do not themselves farm), allowing farmers to reap the most from their sales. **CSA** puts consumers in direct relationship with their food and how it is grown.

Aunger points out that this system, in which consumers see week by week what is being produced and in what quantity, offers its own kind of learning. There might be gorgeous, delicious foraged blackberries. There might also be, say, kale that an insect has fed on. The first astonishment, that the kale is imperfect, gives way to a feeling of marvel: this food is so rich and healthy, of course other creatures want a nibble.

Under **COVID-19** restrictions, this system of getting food to table works especially well. “**CSA** is a great model,” says Emily Vanderwey, manager of the **CSA** program at Earth Haven, “because we can deliver food while complying with the social distancing recommendations. Food from our farms hasn’t travelled as far, hasn’t been touched by as many hands, hasn’t taken as much energy to be produced and distributed.”

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Despite—or perhaps thanks to—their relative size, small farms are often more fleet-footed than larger operations in times of crisis. Within days of the announcement of the Canada–US border closure, Nurse redesigned her crop plan: the large quantities of salad greens that she had planned for the high-end restaurants she previously supplied (and which were not able to open in the pandemic) were swapped out, and a variety of greens and heritage vegetable crops designed to accommodate the different needs of local and urban shoppers got planted instead.

Similarly, in Orono, Ontario, just as Dave Kranenburg and his partner, Emily Tufts, of Kendal Hills Farm, were harvesting mushrooms for contracts with restaurants that would no longer be able to buy them, they immediately reached out to their market network and quickly created an online farmers’ market. Like many brilliant ideas, this one is relatively simple. In its first week, farmers were asked to offer food they had for sale through the online shop, where customers placed their orders. The farmers brought their products to Kendal Hills Farm, where they were sorted, packaged, and delivered to a network of homes not only throughout the **GTA** but also local. The shop grossed \$51,000 in its first week, which suggests a robust demand, with the corollary benefit to farmers of saved transport time and guaranteed sales.

Kranenburg had long been thinking about solutions for the sales and distribution problems his farm and others face, but he says that “this wasn’t a strategic move. It’s not like I was hoping for a pandemic. A lot of us were hoping for a change to the local food system, and something as chaotic as [what] the world is experiencing right now kind of breaks all the habits and norms and allows new ideas that have been percolating to actually maybe take.” Kranenburg hopes projects like this will foretell a paradigm shift in the way Canadians shop for food.

**THE HARD TRUTH** is that food produced in a sustainable way is expensive, and we as consumers need to come to terms with this. Small-scale, sustainable farmers do not use chemical sprays to augment nutrients. They build whole integrated systems using organic and biodynamic techniques that are more labour-intensive, that use less fossil fuel-dependent machinery, and that rely on heritage seeds (and collecting them, as well). They also do this on a more human and humane scale.

Compare this to an industrial organic operation where, for example, chickens are selected for their size or egg-laying capacity and bred for these attributes. A free-range designation, which many large operators now have, means only that the chicken has access to the outdoors, not

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that it actually uses that access point to leave the industrial barn. In a small operation, chicken flocks actually range freely, finding at least some of their own food—which has positive taste and nutrient outcomes. Not housing livestock indoors, not chemically feeding produce, and keeping farm operations human scale all come at a price, but the benefit is borne out in the potential nutrition and flavour of the food and the well-being of the land on which it is produced. Nurse says that the actual cost of producing a dozen organically, sustainably farmed eggs without subsidy is \$8. The cost of sustainable food puts it out of reach for many consumers, yes—but, if organic, biodynamic, and other related kinds of production were supported through subsidy and other funding sources for farmers doing this work in sustainable agriculture, it would help level the playing field, lower prices, and make this food more accessible.

York University's Rod MacRae, whose work focuses on creating a national food-and-agriculture policy for Canada, points out that "the dominant model assumes the supermarkets can keep supply chains operating," adding that "the big-three chains don't participate much in the small regenerative farmer model." In other words, Loblaws, Sobeys, and Metro limit the choices we make insofar as they rarely support local food production. It's always been lamentable (and strange!) to me that I can pass farm-stand displays of plump, juicy tomatoes in July on my way to the Foodland in Madoc, Ontario, only to find that cheap, hard, flavourless versions, trucked in from the southern US or beyond, are my only option. The fact is that these flavourless versions are developed for their ability to withstand diseases and survive transport, not for their taste. They can be produced more cheaply in part because these operations rely on cheap labour.

The industrial food-supply system we have allowed to develop therefore encourages practices that put sustainable farmers at an impasse. Unsupported by the dominant system and forced to market to a capricious consumer, many small operators have had to maintain off-farm income streams in order to keep farming. For years, Nurse has taken on sessional academic work at **OCAD** University, where she teaches printmaking. She also has city customers who hire her company to landscape their properties. In effect, she is "paying to farm by using off-farm income in order to steward the land."

**COVID-19** regulations will make farming even more difficult and expensive as all farmers scramble to keep up with new rules in the face of the pandemic. The extensive variety of financial outreach from the federal government for farms affected by the domino effect of border restrictions

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and other **COVID-19**-related economic perils does not always extend to small-farm operators.

As a thought experiment, I wonder: if given the choice between two heads of lettuce that appear identical, where one is sustainably and locally grown at \$3 and the other has been sprayed with chemicals and imported at \$1, which would you choose? The savvy consumer on a limited budget might well choose with his wallet in mind. But what if, in a perfect world, where our government supported the endeavour of sustainability as an imperative, they cost the same amount? And what if that imperative was an initiative that put its might and will behind the health of its citizens, the health of local food-production economies, and the health of the climate and environment? Which head of lettuce would you choose then?

When asked whether he believes that this pandemic will open a way for a lasting, positive reimagining of the way we think about food production and supply, Ralph Martin, author of *Food Security*, says, "There's no doubt in my mind that this **COVID-19** crisis will help people to understand more about what food is and how it is grown and processed and what foods are healthy. Health is now top of mind, and people have more time than they did before to think about food. It can no longer be taken for granted, and that is positive."

The small-scale farmers I spoke to are eager for this change. Kranenburg tells me that he believes "small farmers are being called to action," adding, "We've got this—we grow food, we can grow lots of food. It's just that we need a different way of getting it to people." Nurse tells me that, within days of putting out a **CSA** call to her network, she had twenty-five families signed up. Small Spade Farm is only a seven-acre operation, but at its capacity, were Nurse to have support from the community, it could supply a weekly **CSA** box to 100 families. A shift like that would allow her to quit her off-farm jobs and concentrate on what she loves to do—feed us. Extrapolate from that number, and it is possible that our local, sustainable farming operations—our farmers—could grow much more of our food than they currently do, while contributing to environmental rejuvenation. Not only that but, in this brave new world, Aunger tells me, "the local farmers will prosper and the community will see a drastic change in their health."

thewalrus.ca, 23 July 2020

<https://www.thewalrus.ca>

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**In social insects, researchers find hints for controlling disease**

2020-07-22

GIVEN THAT SHE infects ant colonies with deadly pathogens and then studies how they respond, one might say that Nathalie Stroeymeyt, a senior lecturer in the school of biological sciences at the University of Bristol in the U.K., specializes in miniature pandemics. The tables turned on her, however, in March: Covid-19 swept through Britain, and Stroeymeyt was shut out of her ant epidemiology lab. The high-performance computers she uses to track ant behavior sat idle, and only a lab technician — deemed an essential worker — was permitted to tend to the lab's hundreds of black garden ant colonies, each housed in its own plastic tub.

With governments across the world now encouraging people to maintain space between one another to prevent the spread of the virus, Stroeymeyt drew parallels with her insect subjects. The current guidance on social distancing “rung familiar,” Stroeymeyt said, “because I’ve been seeing it among the ants.”

Such insights are at the heart of a burgeoning field of insect research that some scientists say could help humans imagine a more pandemic-resilient society. As with humans, fending off disease can be a tall order for social insects — a category that includes termites, ants, and many species of bees and wasps. Insect workers swap fluids and share close quarters. In most species, there is heavy traffic into and out of the nest. Some ant colonies are as populous as New York City.

The insects are “living in very confined environments where there’s a lot of microbial load,” said Rebeca Rosengaus, a behavioral ecologist who studies social insect behavior at Northeastern University in Boston. Many of those microbes, she added, are pathogens that could sweep through the colony like a plague. That rarely happens, social insect researchers say, and vast colonies of such species are somehow able to limit the spread of contagions.

Over the past three decades, researchers have begun to explore just how that might occur, mapping the myriad ways that colonies avoid succumbing to disease. Some of those methods can seem alien. Others, including simple immunization-like behavior and forms of insect social distancing, can seem eerily familiar. Put together, they form a kind of parallel epidemiology that might provide insights for human societies

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battling pathogens of their own – even if, so far, human epidemiologists don’t pay much attention to the field.

Still, those insights are what Rosengaus and some other researchers are now exploring. “How is it possible,” Rosengaus asks, “that an individual that gets exposed to a fungus or a bacteria or a virus, or whatever pathogen there is, comes back to the colony, and does not infect everyone in the colony?”

WHILE SOCIAL INSECTS have been the subject of intense scientific scrutiny for more than a century, the threat of pathogens and other parasites, researchers say, was long overlooked. “The mainstream social insect research has ignored parasites for a very long time,” said Paul Schmid-Hempel, an experimental ecologist at the Swiss public research university ETH Zurich. Biologist E.O. Wilson’s classic 1971 survey of the field, “The Insect Societies,” does not even list “disease,” “pathogen,” “bacteria,” or “virus” in its index.

As a postdoctoral researcher at Oxford in the 1980s, Schmid-Hempel realized that the bees he studied were constantly infested with parasites. He began to formulate questions that would help launch a small field: What if pathogens were not an incidental nuisance to colonies, but a profound threat that shaped the very evolution of their societies? To what extent were things like ant colonies and beehives actually tiny epidemic states?

Observers of social insects have long known that the animals keep their homes meticulously clean. Workers deposit waste and dead bodies outside the nests. Social insects groom each other, and often themselves, frequently. But recent research has documented other adaptations that also fight infection. Some ants, for example, harvest antimicrobial tree resins and spread them around their nests, a process researchers have described as “collective medication.” Social insect species also secrete a pharmacopeia of microbe-killing compounds, which they apply to their bodies and surfaces.

Grooming, too, seems to have unexpected benefits. As some ants clean each other, they transfer small amounts of pathogens to their nestmates. Those mini-exposures, the biologist Sylvia Cremer writes in a recent paper, cause “non-lethal, low-level infections” that “trigger a protective immunization.” She compares the process to variolation, a once-common method for immunizing humans against smallpox by exposing them to a small amount of fluid or dried scab material from a sick person.

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Rosengaus' [research](#) has documented similar social immunization behavior among dampwood termites.

She and colleagues have also [found evidence](#) that, when some members of a black carpenter ant colony encounter pathogenic bacteria, they are able to develop an immune response and share it with their nestmates, making the entire colony more resistant. The ants who have been exposed appear to be passing along immune system compounds, mouth-to-mouth, ahead of the infection, readying their nestmates' bodies for the possibility of exposure. Rosengaus compares this adaptation to a world in which a human could French kiss someone who has received a vaccine — and then gain the benefits of that vaccine indirectly.

These kinds of findings challenge assumptions that social living, by creating ripe conditions for diseases to spread, is automatically a risk to individuals. "Both the risk and the mitigation of risk come from sociality itself," says Nina Fefferman, a professor of ecology and evolutionary biology at the University of Tennessee, Knoxville who studies disease transmission. Other individuals may get us sick. But they can also offer the care, food, and knowledge that saves our lives. "Everything is all rolled into this very complicated set of constraints and goals," Fefferman said.

For social insect researchers, one elusive question is whether, like human public health departments that impose coronavirus quarantines on households and occupancy limits on restaurants, social insect societies actually change their interactions to make it harder for diseases to spread — a phenomenon sometimes called organizational immunity. Most social insect colonies have complex systems for dividing up tasks. Some workers may end up caring for the queen, or feeding larvae, or standing on guard duty, or foraging. Decades of research have analyzed that division of labor in terms of task efficiency. But, starting in the early 2000s, mathematical models suggested that those social divisions might also slow down infections. By only interacting with a few designated workers, for example, a queen may be less likely to get sick.

Testing some of those theories on real colonies, researchers say, has been difficult. But the advent of automated insect tracking systems has opened up new possibilities, allowing researchers like Stroeymeyt to construct detailed pictures of who is interacting with whom inside an ant colony, for example.

To map an ant social network, Stroeymeyt and her fellow researchers glue tiny QR code tags, some smaller than a square millimeter, to ants' thoraxes. Once each ant in a colony has been tagged — Stroeymeyt estimates she

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can personally saddle 500 ants with QR codes in a 12-hour day — the colony is placed in an observation box. Cameras overhead read the QR codes and record each ant's position two times per second, for hours on end. The process generates data about every single contact between ants in the colony — hundreds of thousands of datapoints that, with high-powered computers, can be resolved into a detailed picture of the ant colony's social network.

In 2014, Stroeymeyt and her colleagues mapped the networks of 22 colonies, tallying the interactions in each of them over the course of a few days. Those networks, they showed, did not emerge from random interactions of ants. Their interactions were more compartmentalized. Certain ants had more contact with each other than with other members of the colony.

The automated tracking procedure used by Stroeymeyt and her colleagues detects and highlights ants according to their status — red (workers), blue (queen), or brown (dead individuals). A unique ID number for each ant is displayed in green. When two ants physically interact, they are connected with a yellow line.

At least in theory, those kinds of modular networks alone could slow the spread of infection in the colony. A human virus, after all, spreads more quickly through a lively party of 100 people than it does among 20 isolated clusters of five friends each, who mostly just hang out with each other.

But the bigger breakthrough came after the team exposed individuals in 11 colonies with the deadly ant-infecting fungus *Metarhizium brunneum*, with the other 11 serving as controls. Once the ants sensed the pathogens, those networks changed: Their modularity increased, and different task groups in the colony interacted less than before. Foragers exposed to the fungus demonstrated fewer contacts. Even unexposed ants started interacting differently, keeping a higher proportion of their contacts to smaller circles of nestmates. This process, Stroeymeyt told me, is not unlike social distancing. "It's a very cheap and easy way to protect the colony from an epidemic," she said.

Such research, of course, has only just recently been made possible. As Stroeymeyt points out, it's not clear whether, in the absence of pathogens, the ants' modular social networks have evolved in order to respond to the threat of infection, or whether pathogen suppression is just a useful side effect of patterns that have evolved for other reasons. And while the particular mechanism documented in the research was successful in

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slowing the pathogen's spread, it may be just one of a number available to the colony. In addition, one recent paper raised questions about whether lab conditions, using pathogens like *M. brunneum*, necessarily do much to reflect the disease conditions that colonies battle in the wild.

Still, Stroeymeyt and her colleagues' findings have been widely discussed among insect researchers. And, as she points out, ant distancing would suggest that humans aren't alone in reordering our societies in the face of epidemics.

If anything, Stroeymeyt said the ants' success may offer some validation, and inspiration, to humans struggling through a pandemic. Human public health departments are only a couple of centuries old, while ant societies have been evolving for millions of years. "It's very rare to find a colony collapsing under the weight of a pathogen," Stroeymeyt said. "We know that their mechanisms are extremely effective."

**WHILE INSECT EPIDEMIOLOGISTS** study the work of human epidemiologists, the reverse appears to be less common. In theory, researchers say, social insects could be an ideal model system: a kind of miniature society, with few ethical constraints, in which to explore how disease travels through networks. But, Schmid-Hempel points out, collecting detailed information about insect health is difficult. "In humans, you have a lot of really great data, compared to what we have in social insects," he said. One day researchers might find it useful to test out epidemiological principles in insect societies. "I'm sure it'll come," Schmid-Hempel said. "But it's not yet at that point."

One of the few researchers to bridge the divide is Fefferman, the University of Tennessee researcher. Trained in applied mathematics, Fefferman studies how infections move through networks — insect networks, human networks, computer networks, and even networks in online games. Her research has been published in both entomology and epidemiology journals. A paper she co-wrote in 2007 about a virtual epidemic in World of Warcraft gained extensive attention from public health experts.

Fefferman's research on human epidemiology, she said, draws from her study of insects. "You can look at social insect colonies very much as successful cities," she said. "And then you can say, well, what are the strategies that social insects use, both behaviorally and how they evolve them, that we can then borrow from?"

As an example, she brought up termite cannibalism. When exposed to a bad outbreak, some termites immediately eat the colony's young. Doing

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so, Fefferman argues, helps them eliminate a pool of "highly susceptible" individuals who are likely to serve as a reservoir of infection, allowing the epidemic to linger in the nest.

Human societies are unlikely to adopt cannibalism as a public health strategy. But the basic principle, Fefferman argues, may be relevant during the coronavirus pandemic. "If we think about abstracting that," she said, "that's school closures." The lesson from the termites could be "separate the kids. The kids are going to be a massive puddle of transmission that's going to infect everybody. Don't do that."

This kind of thinking has led Fefferman to build models that aim to find the most effective way to distribute medicines in the midst of a flu epidemic. A new paper she's working on, about how companies can structure their workforces to prepare for pandemics and other disasters, is inspired by the cohort-based model that many insect colonies use to distribute tasks — though that's not likely something she would readily advertise when the final paper is published.

Indeed, Fefferman said she doesn't typically cite the influence of entomology on her work, at least when she's talking with public health experts.

"I'd never run into a public health meeting and be like, 'Guys, BUGS!'" she said. "But maybe if I did, it would be fantastic."

undark.org, 22 July 2020

<https://www.undark.org>

### Claim that coconut oil is worse for biodiversity than palm oil sparks furious debate

2020-07-17

Palm oil has a bad reputation—but is coconut oil worse?

A new study argues coconut production poses a threat to biodiversity—including vertebrates, arthropods, mollusks, and plants—five times greater than palm oil. But the paper, published on 6 July in *Current Biology*, has triggered a ferocious debate on social media, where critics have accused the authors of promoting dubious statistics and an attempt to whitewash palm oil.

"Dear logging companies, should you ever need to justify your destructive and extractive (illegal) activities in the Amazon + SE Asia, or protection

**Some 12.3 million hectares of land are used to cultivate coconut palms, compared with 18.9 million for oil palm.**

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against nature conservation NGO's [nongovernmental organizations] or legal action, please refer to the following paper in @CurrentBiology," primatologist Adriano Lameira of the University of Warwick wrote in one of several sarcastic tweets about the paper.

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Some 12.3 million hectares of land are used to cultivate coconut palms, compared with 18.9 million for oil palm. But coconut oil—used in a range of foods and cosmetic products, and popular for its supposed health benefits—enjoys a much better reputation, says lead author Erik Meijaard, who directs Borneo Futures, a consulting company based in Brunei, and chairs the Palm Oil Task Force of the International Union for Conservation of Nature (IUCN). Consumers associate it more with tropical islands and white sandy beaches than with the deforestation linked to planting oil palm groves.

That isn't deserved, Meijaard and others write in their two-page "correspondence." The authors tallied the number of species under threat from the cultivation of seven vegetable oil crops—according to IUCN's Red List of Threatened Species—and divided those by the global oil production for each crop. Coconut threatens 20.3 species for every 1 million tons of oil produced, they report. For olive oil and palm oil, those numbers are 4.1 and 3.8 species respectively; for sunflower oil, it's 0.05.

According to the paper's supplementary information, the number for coconut oil is actually 18.3, not 20.3; when *Science* asked about the discrepancy, co-author Jesse Abrams of the University of Exeter acknowledged that the calculation contains an error that the authors would ask the journal to correct.

But 18.3 is still a very high number. "The outcome of our study came as a surprise," Meijaard says. The reason is that coconuts are primarily grown on tropical islands, "many of which possess remarkable numbers of species found nowhere else in the world," he says. Indeed, some species have already become extinct because their habitat gave way to coconut palm, Meijaard points out, including the Marianne white-eye (*Zosterops semiflavus*), a bird in the Seychelles, and the Ontong Java flying fox (*Pteropus howensis*) of the Solomon Islands, which was last spotted in 1945. Today, coconut plantations threaten to the Balabac mousedeer (*Tragulus nigricans*), endemic to three small islands in the Philippines, and the Sangihe tarsier (*Tarsius sangirensis*), a small primate endemic to the Indonesian island of Sangihe, according to IUCN's assessment.

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The authors say perceptions of the environmental impacts of different oil crops "often appears to be impaired by shortsightedness and double standards." There's little attention for the millions of songbirds reportedly killed during olive oil harvests in Spain, for instance.

But others say the study paints a misleading picture. The vast majority of the species threatened by coconut palm live in small island nations that together produce only 8% of the global output of coconut oil, says Meine van Noordwijk, a senior research fellow at the World Agroforestry Center. Nearly 80% of coconut oil comes from Indonesia, the Philippines, and India. Excluding the small producers from the analysis would yield a very different number, Van Noordwijk says. He also notes that coconut palms are often planted together with other crops, so it's hard to tease out the crop's harm. Sheherazade, a field biologist who heads Tambora Muda Indonesia, an organization for Indonesian young conservationists, agrees. "We need a finer spatial analysis to discern which crop drives deforestation," she says.

Sheherazade notes the picture is almost exactly the opposite judged by a different, more commonly used metric: Palm oil threatens 17 species per million hectares of cultivated crop, versus 5.3 for coconut oil. But Meijaard says quantifying species risk per million tons of oil is more relevant than per hectare, because consumer demand determines the business.

Other critics take issue with different aspects of the study: In absolute terms, palm oil threatens five times more species than coconut oil, according to IUCN (321 versus 66), and palm oil production is growing much faster. "At least in Kalimantan where gigantic palmoil plantations of 10,000 hectare are savagely carved out of virgin rainforest, coconut gardens tend to be mom & pop operations of 10-20 ha [hectares]," tweeted Biruté Galdikas, a primatologist at the Orangutan Foundation.

Some critics also pointed to a potential conflict of interest: Meijaard has received funding from an Indonesian palm oil company and from the Roundtable for Sustainable Palm Oil, a large multistakeholder group that seeks to make the industry more environmentally friendly.

Co-author Douglas Sheil, a professor of tropical conservation at the Norwegian University of Life Sciences, says the authors didn't seek to vilify coconuts but instead want to enable consumers to make better judgments about which vegetable oils to buy. "Consumers lack objective guidance on the environmental impacts of crop production, undermining their ability to make informed decisions," Sheil says. Coconut is seen as an innocent crop because "global consumers rely heavily on information that

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they receive from the media, which is often supplied by those with vested interests." As to the authors' own interests, Meijaard has been transparent about his funding, and "It is a lazy defense to say that anyone who works with a company is somehow unreliable forever after," Sheil says.

The authors agree the data in the paper aren't perfect. "We wanted to raise awareness with this piece and use it as a call for more data and research," says Abrams, who notes there is a lack of data on the environmental impact of many vegetable crops. "We know a lot about oil palm. Why is there such a bias?" Meijaard asks.

But Sheherazade says she worries the paper will be used to undermine environmental activism against unsustainable oil palm practice in Indonesia, especially now that new plantations are springing up in pristine forests in Papua. "Oil palm is still a huge threat to biodiversity," she says. "The palm debate is very polarized, extra care is needed to avoid creating new myths," Van Noordwijk adds.

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sciencemag.org, 17 July 2020

<https://website>

### How bats have outsmarted viruses—including coronaviruses—for 6.5 million years

2020-07-22

Although the SARS-CoV-2 virus has sickened more than 14 million people, bats contract similar viruses all the time without experiencing any known symptoms. Now, the newly sequenced genomes of six species spanning the bat family tree reveal how they've been outsmarting viruses for 65 million years.

The findings are an "excellent starting point for understanding the superstar immune systems of bats," says Laurel Yohe, a postdoc at Yale University who studies bat evolution and was not involved with the work.

With more than 1400 species, bats are the second most diverse group of mammals on Earth. They live on every continent except Antarctica, and range in size from two to more than 1000 grams. They fly, they echolocate, and some live up to 41 years—a long time for animals of their size. They are also known to carry many different kinds of viruses, including coronaviruses, with no ill effects.

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To discover their secrets, an international consortium launched the Bat1k project, which stands for bat 1000, in 2017 to sequence the genomes of all bat species. Six of those genomes are now complete, the consortium reports today in *Nature*.

The genomes are more thorough and more accurate than previously sequenced bat genomes, says Jon Epstein, a disease ecologist at EcoHealth Alliance who was not involved with the work. "That allows [researchers] to make some strong comparisons with other animals, including humans."

The researchers in the consortium did just that, comparing the newly sequenced genomes with those of 42 other mammals, from manatees to people. They found that the bats' closest relatives aren't tree shrews, flying lemurs, or even mice (as has been proposed); instead, they formed their own group early on that may share a common ancestor with the mammals that eventually evolved into horses, pangolins, whales, and dogs.

Further analysis revealed bats have disabled at least 10 genes that other mammals use to mount inflammatory responses against infection. But they also have extra copies and modifications of antiviral genes that may explain their high tolerance for disease. Finally, their genome is littered with DNA pieces derived from past viral infections that got incorporated when the viral genomes were replicated.

"These nonbat genes leave a kind of medical record ... a diary of previous infections," Yohe says. That diary reveals that bats have probably had more viral infections than all other mammals over time and have even been infected by viruses thought only to attack birds, the team reports. "The findings highlight bats' ability to tolerate and survive viral infections more efficiently than other mammals," says Sharlene Santana, an evolutionary biologist at the University of Washington, Seattle.

The analysis may also resolve the evolutionary origins of bat echolocation, a hunting technique in which bats emit sounds that help them locate insect prey. Some researchers have argued that echolocation evolved later in bat evolutionary history and may even have evolved twice. But the five echolocating bats sequenced have the same versions of several genes involved in hearing, suggesting those versions likely evolved in the ancestor of bats, the team reports.

In the next year, Bat1K researchers plan to sequence 27 more genomes—one bat from each family. They are now seeking funding to do the rest, says Emma Teeling, the project's co-founder and a zoologist at University College Dublin. Yet these first six genomes will continue to have an impact,

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says Amy Russell, an evolutionary biologist at Grand Valley State University. "I think this paper will be extremely influential for years to come."

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sciencemag.org, 22 July 2020

<https://www.sciencemag.org>

### Two cruise ships hit by coronavirus weeks after industry restarts

2020-08-03

Covid-19 has been detected on at least two cruise ships – one in the Arctic and one in the Pacific – just weeks after cruising holidays restarted.

At least 40 passengers and crew from the MS Roald Amundsen have tested positive for the novel coronavirus, and authorities are trying to contact trace hundreds of passengers from two recent Arctic voyages the ship took.

Four crew members on the MS Roald Amundsen were hospitalised on Friday when the ship arrived at the Norwegian port of Tromsø, and later diagnosed with the respiratory illness. Tests showed another 32 of the 158 staff were also infected.

But 178 passengers were allowed to leave the ship in Tromsø, triggering a complex operation to locate them in order to contain any potential spread.

So far, four of the 387 passengers who travelled on the ship on two separate cruises since 17 July have been found to carry the virus, the Norwegian Institute of Public Health (FHI) and the Tromsø municipality said.

"We expect that more infections will be found in connection to this outbreak," Line Vold, a senior FHI executive, said. Passengers have been told to self-isolate.

The Hurtigruten line, owner of the MS Roald Amundsen as well as 15 other vessels, in mid-June became the first to return to oceangoing cruises following a three-month halt due to the pandemic.

Asked later on Sunday whether the authorities had by now located and tested everyone potentially infected aboard the cruise liner, an FHI spokesman said: "Messages have been sent to all the passengers.

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We're now seeking to verify that the information has been received and understood."

In March, the Roald Amundsen was stranded at sea for several days with more than 100 passengers on board, after Chile refused it entry to port because of confirmed coronavirus cases on the ship.

In the Pacific, passengers aboard the Paul Gauguin – docked in Papeete, Tahiti – have been told to stay in their cabins after Covid-19 was detected on board by the ship's doctor, French Polynesian press reports.

The Paul Gauguin was sailing between Bora Bora and the Rangiroa islands, when a positive case was detected in a crew member. The ship immediately turned around to head back to its home port.

It is not known how many passengers are on board – numbers have been reduced as part of the Ponant company's strict coronavirus protocols – but infectious disease specialists will test every person on board.

Ponant has been contacted for comment.

The Paul Gauguin resumed sailing on 18 July for local residents, and on 29 July for international guests. French Polynesia opened its borders to all nationalities on 15 July.

Travellers to French Polynesia must take a Covid-19 test – and return a negative result – within three days of leaving for the islands. A further test is required shortly after arrival.

theguardian.com, 3 August 2020

<https://www.theguardian.com>

### Fructose alters hundreds of brain genes, which can lead to a wide range of diseases

2020-08-02

A range of diseases -- from diabetes to cardiovascular disease, and from Alzheimer's disease to attention deficit hyperactivity disorder -- are linked to changes to genes in the brain. A new study by UCLA life scientists has found that hundreds of those genes can be damaged by fructose, a sugar that's common in the Western diet, in a way that could lead to those diseases.

**"DHA changes not just one or two genes; it seems to push the entire gene pattern back to normal, which is remarkable,"**

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However, the researchers discovered good news as well: An omega-3 fatty acid known as docosahexaenoic acid, or DHA, seems to reverse the harmful changes produced by fructose.

“DHA changes not just one or two genes; it seems to push the entire gene pattern back to normal, which is remarkable,” said Xia Yang, a senior author of the study and a UCLA assistant professor of integrative biology and physiology. “And we can see why it has such a powerful effect.”

DHA occurs naturally in the membranes of our brain cells, but not in a large enough quantity to help fight diseases.

“The brain and the body are deficient in the machinery to make DHA; it has to come through our diet,” said Fernando Gomez-Pinilla, a UCLA professor of neurosurgery and of integrative biology and physiology, and co-senior author of the paper.

DHA strengthens synapses in the brain and enhances learning and memory. It is abundant in wild salmon (but not in farmed salmon) and, to a lesser extent, in other fish and fish oil, as well as walnuts, flaxseed, and fruits and vegetables, said Gomez-Pinilla, who also is a member of UCLA's Brain Injury Research Center.

Americans get most of their fructose in foods that are sweetened with high-fructose corn syrup, an inexpensive liquid sweetener made from corn starch, and from sweetened drinks, syrups, honey and desserts. The Department of Agriculture estimates that Americans consumed an average of about 27 pounds of high-fructose corn syrup in 2014. Fructose is also found in most baby food and in fruit, although the fiber in fruit substantially slows the body's absorption of the sugar -- and fruit contains other healthy components that protect the brain and body, Yang said.

To test the effects of fructose and DHA, the researchers trained rats to escape from a maze, and then randomly divided the animals into three groups. For the next six weeks, one group of rats drank water with an amount of fructose that would be roughly equivalent to a person drinking a liter of soda per day. The second group was given fructose water and a diet rich in DHA. The third received water without fructose and no DHA.

After the six weeks, the rats were put through the maze again. The animals that had been given only the fructose navigated the maze about half as fast as the rats that drank only water -- indicating that the fructose diet had impaired their memory. The rats that had been given fructose and DHA, however, showed very similar results to those that only drank water

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-- which strongly suggests that the DHA eliminated fructose's harmful effects.

Other tests on the rats revealed more major differences: The rats receiving a high-fructose diet had much higher blood glucose, triglycerides and insulin levels than the other two groups. Those results are significant because in humans, elevated glucose, triglycerides and insulin are linked to obesity, diabetes and many other diseases.

The research team sequenced more than 20,000 genes in the rats' brains, and identified more than 700 genes in the hypothalamus (the brain's major metabolic control center) and more than 200 genes in the hippocampus (which helps regulate learning and memory) that were altered by the fructose. The altered genes they identified, the vast majority of which are comparable to genes in humans, are among those that interact to regulate metabolism, cell communication and inflammation. Among the conditions that can be caused by alterations to those genes are Parkinson's disease, depression, bipolar disorder, and other brain diseases, said Yang, who also is a member of UCLA's Institute for Quantitative and Computational Biosciences.

Of the 900 genes they identified, the researchers found that two in particular, called Bgn and Fmod, appear to be among the first genes in the brain that are affected by fructose. Once those genes are altered, they can set off a cascade effect that eventually alters hundreds of others, Yang said.

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medicalnewstoday.com, 2 August 2020

<https://www.medicalnewstoday.com>

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**The Butterfly Effect**

2020-07-31

CARLOTTA JAMES feels as though her bones are breaking. She's running through what she calls a "dead zone," a stretch of empty towns with nowhere to refill her hydration pack. She'll have to ration the water she has left for the remainder of today's fifty-kilometre stretch. As she keeps moving forward, James looks up and sees flutters of orange against the sky's blue. It's the monarchs. The butterflies remind her that she can't give in to her fatigue, can't stop moving, save for those brief moments when, overcome by emotions, she pauses to take in the nature around her. James is running alongside the monarch's annual migration, and the monarchs stop for no one.

It's the first Friday in October, and James is about two weeks into the Monarch Ultra, a 4,300-kilometre journey that set off from her hometown of Peterborough, Ontario, in mid-September. The ultramarathon—roughly seven weeks of running, fifty to 100 kilometres each day—mirrors the monarch's exact route and schedule, a trail going from southern Ontario, down through the United States, finally ending at the monarchs' overwintering grounds in Cerro Pelón, Mexico.

James is the project director for the continent-spanning journey, which she is undertaking alongside a three-person team that includes a run director, a filmmaker, and a chef/RV driver. Each day, the ground is covered by either James, a teammate, or a volunteer—often members of local conservation groups, students, professors, or government officials. And, as always, there are the monarchs: human and insect are battling the same thirty-degree heat, breathing the same polluted air, and often travelling paths made more dangerous by cars and trucks. "The monarch butterflies don't have it easy," James says.

James first dreamed up the idea in the summer of 2016, during a run along the Kawartha Trans Canada Trail, in Peterborough, where she has a local business planting pollinator gardens. Ontario was engulfed in a drought that year, and James had seen only a handful of monarchs outside. "It would be a fantastic idea to just follow their migration through the act of running," she remembers thinking. It is auspicious (if not downright lucky) that, when she set out on her ultramarathon, three years later, it was following what James calls an "epic comeback" for the species: in 2019, southern Ontario saw the highest number of butterflies in recent years.

However, the monarchs' migratory life cycle means that the species' health can change dramatically from one year to the next. And, like many other

**"The monarch butterflies don't have it easy," James says.**

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species, monarchs are now facing an existential threat that is increasing due to climate change—in 2016, Canada officially listed monarchs as an endangered species.

But, unlike other endangered creatures, from Fowler's toads to American eels, monarch butterflies have many champions. The butterflies have long been symbols of beauty, transformation, and hope for many in North America, and consequently, scores of committed citizen-scientists and do-gooders have started doing their part to help the species survive. Scientists have recently pointed to this love, which sometimes borders on obsession, as a likely factor in the monarch's surging 2019 population. Monarch fever can, fittingly, cause a butterfly effect: at a time when damage to the environment can seem impossible to reverse, the butterflies are a living reminder that even the smallest actions can lead to enormous results.

AMONARCH CHRYSALIS IS jade green at first, with golden ribbons running through. Some people describe these shells as akin to jewellery. As time passes and the monarch grows inside, the chrysalis darkens until a patch of orange with a black vein can be seen through the translucent green. The chrysalis continues darkening, turning almost completely black, until the butterfly is ready to slowly unfold itself. The monarch's wings, crumpled and small at first, expand during its first hour in the world. Then, after a few slow flaps, it is ready to fly.

Watching this process from her porch in Hiawatha First Nation, near Peterborough, is something Sandra D. Moore looks forward to each year. Her husband has made three cages, which, in the summer months of last year, were filled with butterflies at every stage in their life cycle. She watches it all: the chrysalis, the caterpillar, the larva, the eggs. "My summers are not really productive when the butterflies are going on," she jokes.

Moore started raising monarchs about ten years ago, after her niece, a teacher, went through the process with her students. Moore's curiosity was piqued, and she and her husband have raised butterflies off and on ever since. Throughout late summer, the two go on walks through farmer's fields and along old railway tracks, keeping an eye out for caterpillars and eggs to nurture—they raised and released 300 last year alone.

According to Moore, it's "a big day" when one of her monarchs hatches and she is able to hold it in her hands. "I can't say there's not an emotional connection with that," she says. Moore and her husband have noticed that,

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though the female monarchs fly away instantly, the males tend to linger on nearby bushes. She likes to joke, “Buddy, I’m not packing your lunch.”

When she thinks about the dangers that the species is facing, Moore gets emotional. “When I hear political leaders say that climate change is a hoax,” she says, “it makes me weepy to think that we have messed up this environment so bad that some of the things we’ve seen and enjoyed aren’t going to be there for the future.”

Raising butterflies at home is a hotly debated issue, with some arguing that domesticated butterflies don’t fare as well on migrations as their wild counterparts. But Moore has done her own research. She says that the eggs and caterpillars she plucks from fields would be in for a certain death if a farmer plowed through them with a combine. “I think that releasing 200 or 300 monarchs from this little corner of the world isn’t going to translate into a big, huge number when they actually go [to Mexico],” she says. But she’s still optimistic about what she does: “Every one makes a difference.”

Millions of butterflies make the annual migration to the overwintering grounds, which, for many, are the oyamel fir forests on the mountains west of Mexico City. The region’s cool air helps the butterflies preserve energy over the long winter months, and the monarchs are protected by both the tree canopy and their proximity to one another. Since scientists can’t count the individual butterflies to gauge the strength of the species, every year they count how much land the butterflies take up when they “roost,” or cluster together for warmth. In 2014, monarchs occupied 0.67 hectares. In 2018, they filled 2.48 hectares. Last year, it was 6.05 hectares—a remarkable increase. But there is a fickleness to monarch populations: this winter, the numbers shot back down again: 2.83 hectares, a 53 percent decrease.

Monarchs are a multigenerational species. The butterflies that arrive each summer in southern Ontario live for approximately two to six weeks. Usually, three generations live and die on the journey north over the summer months. The fourth generation, born in Ontario from mid-August to September, is the “migratory generation”—the one that makes the long, perilous journey south and overwinters in Mexico. This cohort lives for approximately nine months and reaches sexual maturity later than the others. In the spring, this generation finally procreates, and they, along with their offspring, start the migration north. The cycle begins anew.

Greg Mitchell, a wildlife research scientist for Canada’s federal government, says one indicator of future monarch populations is spring temperatures in

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the southern United States. His team used fifteen years of community data to find that warm spring temperatures mean more monarchs. This factor is critical for both milkweed growth and migration. If the temperatures are good, then the first generation of monarchs is likely able to reproduce more. If weather conditions are abnormal—something that is becoming more and more likely due to climate change—it can cause this generation to fail to prosper, setting the tone for the rest of the year.

In 1986, forests where monarchs overwinter were designated natural protected areas by the Mexican government, and they later became a UNESCO-designated site. But these important ecosystems remain threatened by warming temperatures: models for the region predict that trees will be affected by heat and droughts in the coming years, making them more vulnerable to insects and disease, according to one 2015 study.

Ryan Norris, a professor at the University of Guelph who has been researching monarchs for the past ten years, warns that even last year’s high population was significantly lower than historical highs. He’s concerned about the long-term prospects for the species, noting that important flora for monarchs, including milkweed and other nectaring flowers, continue to be lost due to pesticides. Based on population models, he predicts the availability of milkweed, along with overall monarch butterfly habitats, will keep diminishing in the years ahead.

LISA MASSIE RECALLS seeing monarch butterflies everywhere when she was growing up in the 1970s and ‘80s. Then, a few years ago, the Toronto high-school administrator read a statistic about the decline of butterfly and bee populations that was so jarring she now calls it her “wake up call.” (One 2016 study reported that the population of eastern monarchs had declined by 80 percent in the past decade and suggested the species had a substantial chance of becoming extinct in the next twenty years.) But, as Massie soon learned, there were clear steps she could take to make a small difference.

In 2018, she bought bee balm and allium plants for her small Mississauga backyard garden, and last year, after doing more research, she added more: lavender, liatris, Joe-pye weed, and hibiscus. Massie isn’t the only one making insect-friendly gardens, and she noticed that landscaping stores have picked up on the growing trend, with some even adding signs with butterfly and bee images to signify pollinator plants. As Massie says, the fight to save butterflies and bees is literally a grassroots effort.

Scientists say that people like Massie can in fact have a significant effect on monarch populations. Milkweed, in particular, is crucial for monarchs,

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who feed on it as caterpillars and lay their eggs on the plant as butterflies. A toxin within the plant is stored in the caterpillars' systems, making both them and their butterfly forms poisonous to predators.

The increase in milkweed across southern Ontario in recent years has been a result of both individual actions and larger efforts from conservation groups. In 2013, the David Suzuki Foundation launched its #gotmilkweed campaign to encourage people to plant the species. The foundation says this resulted in 10,000 new plantings of milkweed in just two years. In 2014, Ontario's agriculture ministry removed milkweed from its list of noxious weeds, meaning it was no longer mandatory to pull it from the province's farmlands.

When people like Massie plant pollinator gardens or milkweed, they're helping not only monarch butterflies: these plants also benefit the hundreds of bee species in the Toronto area alone. "If you're supporting a more diverse ecosystem in your backyard, you're supporting more life than you really realize or than can ever be concretely measured," says Aaron Fairweather, a PhD student in entomology at the University of Guelph.

Fairweather, whose interest in entomology was sparked by learning the monarchs' annual migration as a child, says the fact that many people identify so closely with monarchs has been a boon for conservation efforts. "We usually think about [monarchs] as having a very ephemeral life... but we see this strength within a small species, and people identify with that," they say. "They get this emotional backing behind it."

But, while monarchs and honeybees have proven to be "charismatic" species that draw the public's attention, Fairweather says there's a need to diversify our focus toward more insects. A 2019 study suggests that 40 percent of insect species worldwide are currently threatened with extinction due to climate change, chemical pollutants, and invasive species. Fairweather estimates that there are hundreds of millions of species that haven't even been documented yet. Many of these could also be at risk. As Fairweather says, not every bug is as vibrant as a monarch, but every insect has a story of its own.

AMONARCH CAN FLY as high as the clouds. With wind travelling in the right direction, the butterflies glide on the current, sometimes not even needing to flap their wings. But, when the wind is against them, they fly lower, gathering together in clusters. As the monarchs fly south, they eventually join together in a single path, trailing from central Texas into Mexico. When they arrive in the latter, you can actually hear the fluttering of their wings.

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The monarchs' migration might begin in southern Ontario and end in Mexico, but it's not a continuous journey. They make pit stops along migratory corridors to roost and recharge. Monarchs are cold-blooded and need sunlight to warm the muscles that allow them fly. But they are also sensitive to extreme heat. It's thought that the butterflies' migration is similar to our work lives: an eight- or nine-hour commitment during the day followed by a long rest overnight. When it's time to stop, the monarchs must come down to earth, and the land is always changing.

If monarchs had words to describe what they saw when they glanced down from the sky, they'd lament these changes. Today, swaths of their migratory path are covered by dense agricultural zones with fewer nectaring flowers for monarchs to feed on. Insecticide used on farmland also poses a risk to monarchs' survival.

Travelling through these agribusiness areas, monarchs encounter little wildlife and ever fewer trees. "That's probably one of the worst things to happen to twenty-first century agriculture," says ultramarathoner Carlotta James, noting the pesticides and chemicals used in the businesses. Having adequate nectaring flowers at the monarchs' pit stops is just as important as having pollinator plants in southern Ontario and oyamel fir trees in Mexico. There is some awareness of the importance of this: in April, the US announced that it would preserve millions of acres of monarch habitats along transportation corridors, with the aim of helping revive monarch and other pollinating insect populations.

This decision is especially important because, due to their migration, monarchs will feel the negative effects of climate change more than some other species will, Fairweather says. As the climate warms, monarchs may stay in Ontario longer, resulting in less milkweed and fewer nectaring flowers to go around. This could mean the butterflies will have less energy to make their journey. Changing precipitation patterns also mean that the monarchs may be travelling through Texas right in the middle of hurricane season. An extreme weather event has the potential to decimate the population, Fairweather says.

Greg Mitchell, the federal researcher, says the scientific community hasn't yet adequately addressed all the ways in which climate change threatens the monarchs. Some research shows that it could affect the oyamel fir forests where monarchs overwinter, he says. Other data suggests milkweed distributions might shift north, expanding the monarchs' breeding habitats. But, Mitchell says, we still need to make sure monarchs have enough habitat and breeding grounds to survive: essentially, more

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milkweed and nectaring flowers all the way across North America. To help ensure that this occurs, Mitchell is part of the Trilateral Monarch Conservation Science Partnership, a research group made up of scientists from Canada, the United States, and Mexico that has developed a network, alongside the Commission for Environmental Cooperation, to centralize monarch data and bolster efforts across the continent. James puts it simply: "If we can save the monarch butterflies, then we can probably save other species as well."

MONARCHS MEAN different things to different people. To some, the orange insects represent a visit from a deceased loved one. The belief can be traced back thousands of years to Mexico's annual Day of the Dead festival, which coincides with the millions of monarchs that return home.

To Ann Marie Gill, a former corporate sales consultant, monarchs represent transformation. In 2018, she found a caterpillar on a milkweed plant in her community garden during a time when one of her dogs was in the hospital. She decided to care for the insect and purchased a glass structure for it to call home. She searched the internet and called local experts for advice, learning to feed the caterpillar milkweed and to clean its living space every day. She watched, mesmerized, as the caterpillar spun its jade cocoon. When the butterfly hatched, she named him Milagro, Spanish for "miracle."

When it was time to release Milagro, Gill cried. Everything about the butterfly seemed auspicious and lucky. Before letting Milagro go, she talked to him. "It's like he totally understood me and was hanging out with me," she says. As she spoke with Milagro, her nose touching him, the butterfly fluttered his wings.

Last April, Gill was in a car accident and got a concussion. During this trying time, as she raised another sixteen monarchs from her living room, Gill thought of how caterpillars, as they grow into butterflies, reinvent themselves. "[I was] kind of in my own cocoon while I was healing," she says. "Part of that is being around that transformation energy while I'm also reinventing myself. It's been really healing and magical and spiritual."

Dorothy Taylor also feels a spiritual significance to butterflies. Taylor is a member of Curve Lake First Nation and the founder of Sacred Water Circle, a volunteer community group that advocates to protect water in the area. Butterflies, she tells me, are part of a creation story in which Sky Woman gave birth to twins: one who was born normally, and one who was born from her left armpit, killing her. When the twins grew up, they chased after butterflies, who, as Taylor says, "gave them the strength to start being

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fascinated, to open their eyes to the world around them."The twins were responsible for the work of creation: one twin created a rose, and the other gave it thorns. There's also a dance at powwows, shared across First Nations in North America, called the Girls Fancy, also referred to as the butterfly dance. It's a quick dance involving lots of jumping, usually done by young women, that mimics the movement of butterflies and represents transformation.

Similar to Fairweather, Taylor says that monarch butterflies have the potential to be a "mascot" for people to care more about all insects. Because of her Indigenous teachings, she doesn't kill any spiders or other "creepy crawlies" she finds in her house—she simply carries them outside. She believes everything is interconnected, similar to the spider webs she sometimes sees in the corners of her room. "Right now, the way our world is, there's a competition between the natural world and our comfort as people," she says. "It's caused a disruption." Monarch butterflies in particular, she notes, can arouse human curiosity. "How do they survive travelling from [southern Ontario] to Mexico and back again? How do they do that?" she asks. "That's tremendous strength and magic. We'd consider that ordinary magic. And we have to show them respect."

UNDER LARGE ORANGE TENTS, schoolchildren wearing black shirts and shorts with orange monarch butterfly wings are dancing for an audience of around 400. Orange letters on a black sign read, in Spanish, "Welcome Monarch Ultra Marathon." Later, there will be a mariachi band, food, and speeches—all organized by the Macheros community as a surprise for James and her team. The group arrived at their destination in Cerro Pelón on November 4, right on schedule.

"From the moment we crossed the border in Mexico, we were constantly surprised," James says. "The community participation was huge. Canada and the States have a lot to learn when it comes to how to galvanize communities to support big projects."

The November 4 celebration was the end of the 2019 Monarch Ultra, but James is quick to point out that it was also the beginning of something greater. She is now hoping to organize another ultramarathon in the years ahead. Because of the support the project received in Mexico, she feels a responsibility to do an even better job next time and get more levels of government, schools, and conservation groups involved.

For most of last year's journey, the team saw streams of monarchs overhead. As the runners got closer to Mexico, the butterflies sometimes numbered in the thousands. But it was only when the team was on the

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bus heading home to Peterborough that they looked out the window to see even bigger waves, tens of thousands of monarchs, streaming south. James later joked that, with their meticulous timekeeping, her team had run too fast for the monarchs.

No matter the planning or predictions, the monarchs fly on their own schedule, following the intuition that leads them generation after generation, year after year. There is still some mystery to the monarchs, and as James says, "Maybe that's how it was supposed to be."

thewlarus.ca, 31 July 2020

<https://www.thewalarus.ca>

### Paris beehives trace Notre-Dame's toxic fallout

2020-07-29

The hundreds of tons of lead that burned in the April 2019 fire that nearly destroyed Notre-Dame cathedral in Paris created a dangerous dust that landed in parks, buildings and playgrounds, raising health alarms. Now, scientists say, some of that lead has found its way to a surprising place: honey produced by urban beehives.

A study outlined this week in Environmental Science & Technology Letters found that honey samples collected northwest of the cathedral, downwind from the fire, contained nearly three times as much lead on average than did those from before the fire.

As investigators continue to seek the origins of the fire that ravaged the 850-year-old cathedral, and scientists, architects and historians study the building's fragile structure and the debris, other research has focused on the pollution caused by the 460 tons of lead that burned that night.

The honey study, conducted by Kate Smith and Dominique Weis of the University of British Columbia, is one of the first to explore the relationship between pollution from the fire and its impact on residents through a product they can ingest directly.

The honey's lead concentration — an average of 2.3 nanograms per gram — fell within consumable standards, said Ms. Smith, a doctoral candidate in geological sciences and the lead author of the study.

She said the higher lead levels matched the geographical distribution of the dust cloud that was carried across Paris from the fire.

**In one hive, the levels were nearly nine times normal.**

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"The evidence is pretty strong that the fire caused the lead elevation observed in the honey," Ms. Smith said.

Urban beekeeping has increased sharply in cities like Paris over the past decade, and the city estimated recently that it has more than 1,000 hives. Bees have taken up residence on the roofs of the gilded Opera Garnier and prestigious restaurants, in the flower-rich Luxembourg Gardens, and at Notre-Dame, too, where 200,000 bees that lived on the roof survived the fire.

The study on the Parisian hives drew from 36 honey samples that were collected in July 2019, several months after the fire. Samples from before the fire were used as a reference point.

It found that honey collected downwind of Notre-Dame had lead levels three times those in samples collected elsewhere in central Paris not only before the fire, but also after. In one hive, the levels were nearly nine times normal.

Ms. Smith said that while the levels measured in the honey were safe, Parisians were right to have been worried about alarming lead concentrations in the aftermath of the fire. "Lead is recognized for its toxicity," Ms. Smith said. "The health risk doesn't diminish simply because the lead was not deposited recently."

Ms. Smith's research focuses on how bees can act as sensitive pollution detectors. When bees forage for pollen or nectar, they pick up tiny particles of lead and other metals, and the honey they produce provides a snapshot of their hive's immediate surroundings.

Researchers continue to be concerned about the effects of pollution from the Notre-Dame fire.

In a study of lead levels in Parisian soils published earlier this month, scientists at Columbia University found that people living within 1,100 yards and downwind of the fire were likely to have been exposed to more lead fallout than previously announced.

Previous investigations by the French news website Mediapart and later by The New York Times found unsafe lead levels in dozens of places across Paris, including schools, parks and day-care centers.

City and state authorities did not order lead testing until a month after the fire, and it took four months to complete a full decontamination of the cathedral's neighborhood.

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If ingested, lead can produce cognitive damage, especially in children. City officials have acknowledged that Paris needs a more comprehensive lead-abatement plan, and scientists are investigating whether rainwater dropping from the roof of Notre-Dame may have polluted the Seine river for centuries.

Professor Weis, the other lead author of the study, was in Paris the day after the fire and said she has stayed far from the cathedral out of fear of lead exposure. Although the lead levels measured in the honey accounted for “80 drops of water in an Olympic swimming pool,” she said, they should still act as a warning.

“For Paris, it’s not dramatically high and it doesn’t mean that the honey cannot be eaten,” Professor Weis added about the lead levels. “But honey here is the canary in the coal mine.”

[nytimes.com](https://www.nytimes.com), 29 July 2020

<https://www.nytimes.com>

### Soap dodger: meet the doctor who says we have been showering wrong

2020-07-28

When James Hamblin tells people he has not used soap in the shower for five years, they tend not to hold back in expressing their disgust. “It’s one of the few remaining things for which we feel fine telling someone that they’re gross,” he says. “It’s amazing to me, honestly.”

Yet despite people’s “clearly moralising judgments”, Hamblin is no hygiene slouch. Even pre-pandemic, he made a point of washing his hands with soap. He is, after all, a doctor who lectures at the Yale School of Public Health and a medical writer and podcaster for [the US magazine the Atlantic](#). At 37, he looks so youthful that he still gets compared to the fictional child doctor Doogie Howser.

But eschewing soap on your pits and bits does raise awkward technical questions, more on which after some context. Hamblin’s minimalist showering habits evolved gradually, after he relocated from California to a studio apartment in Brooklyn, New York, to pursue a writing career. He needed to save time, money and space. Simultaneously, he says: “I started learning about emerging microbiome science and decided to try going all-out for a bit.”

### Stigmatism of body odour began as an advertising strategy that helped quadruple the sales of Lifebuoy soap in the 20s.

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Even if you have not yet read up on [our microbiomes](#) – the trillions of microbes that lead symbiotic lives with humans, colonising our skin and our guts – you may have spotted vague statements such as “microbiome-gentle” printed on bottles of shower gel. This because microbiologists – and brands – are learning more and more about the complex relationship we have with our germs. These include their starring roles in developing our immune systems, protecting us from pathogens (by creating antimicrobial substances and competing with them for space and resources) and lessening the likelihood of autoimmune conditions such as eczema. So, there is a growing awareness that scrubbing them off, along with the natural oils on which they feed, or dousing them with antibacterial products may not be the best idea after all.

Hamblin’s new regime got him thinking about modern notions of cleanliness, what is natural and how these two issues are, frankly, all over the shop. Stigmatism of body odour began as an advertising strategy that helped quadruple the sales of Lifebuoy soap in the 20s. A century later, we still live in fear of anyone detecting the slightest hint of BO on us. We are more perfumed, moisturised and exfoliated than ever.

Yet despite advances in skincare and modern medicine, conditions such as acne, eczema and psoriasis, as well as other autoimmune diseases, have been rising steadily. Also, while we attempt to appear squeaky clean, research has revealed that [many of us don’t wash our hands properly](#) – or at all – when it matters most: before eating and after going to the toilet. (That said, awareness of the importance of handwashing has certainly risen as a result of Covid-19.)

“It’s all mixed up right now, right?” says Hamblin, who set out to explore these paradoxes in perceived cleanliness in his book [Clean: The New Science of Skin and the Beauty of Doing Less](#). He says the key to the success of his experiments, which saw him all but give up deodorant, was his “slow-fade” approach. “As I gradually used less and less, I started to need less and less,” he writes. “My skin slowly became less oily, and I got fewer patches of eczema. I didn’t smell like pine trees or lavender, but I also didn’t smell like the oniony body odour that I used to get when my armpits, used to being plastered with deodorant, suddenly went a day without it.” As his girlfriend put it, he smelled “like a person”.

It is not that we were unaware of bodily odours before “BO” was coined, but Hamblin thinks our natural smells are far more nuanced and informative than we give them credit for. “We know from historical writings that certainly people smelled bad. We didn’t just accept all smells,”

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he says. "Now, if someone smells sweaty or of anything less than soap, perfume or cologne, we think of that as being unclean."

Hamblin started to notice that he smelled less pleasant when stressed. He interviewed a researcher who could train dogs to sniff out cancer in humans, while lovers he spoke to told him they thought the way their partner smelled naturally was good. He writes: "The hundreds of subtle volatile chemical signals we emit may play roles in communicating with other people (and other species) in ways we're just beginning to understand."

Hamblin also highlights the bare-faced cheek behind the rise of the skincare industry, as soap progressed from a multipurpose, often homemade product to a seemingly infinite parade of near-identical concoctions advertised for different problems, genders and occasions, at wildly different prices. Once hooked on daily soapings that remove our natural oils, we needed moisturisers and hair conditioners to replace them. In the 50s, the industry further cashed in by highlighting the drying effects of soap and offering milder detergents. Today, Hamblin writes, we have come full circle; many people seek products that are "as close as possible to nothing at all".

He writes about a fellow journalist – and soap dodger – [Maya Dusenbery](#), who had been prescribed every acne treatment going. The only one that worked? Nothing at all.

She had tried astringents, to dry out the skin; oral and topical antibiotics; the pill; and isotretinoin, a drug that has been linked to [side-effects such as suicidal thoughts](#) and inflammatory bowel disease. Not only were these ineffective, but she also developed rheumatoid arthritis – an agonising autoimmune condition. When she started taking immune-suppressing medication for that, her hair started falling out.

Enough was enough: Dusenbery stopped taking any medication for her skin. After an extremely oily few months, it settled. Now, the only things that touch her face are a microfibre cloth and water. Thanks to her adoption of a more holistic approach to her rheumatoid arthritis, in consultation with a specialist, this has gone into remission, too.

On the subject of antibiotics, Hamblin writes that they have commonly been prescribed for acne; he says they "seem to play a part in causing and exacerbating autoimmune disease" and that "antibiotic overuse is likely to be a bigger threat to biomes than hygiene".

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Perhaps as a result of experiences such as Dusenbery's, microbiologists, dermatologists and skincare companies are striving to create new medicines for skin conditions, along with mainstream beauty products that contain live bacteria or ingredients that could feed our microbiomes. [There is even the prospect of bespoke products](#) from beauty behemoths such as L'Oréal that are tailored to our own skin microbiomes, which are as unique as our fingerprints. But we are certainly not there yet – and we should be wary, says Hamblin, of "anyone who's out there right now selling a single microbe, or who tells you that you have a certain [microbial] imbalance you need to get corrected medically".

There is a good chance we will never understand our microbiomes well enough to manipulate them confidently and to positive effect. "Maybe there are some things we can do, but ... it keeps coming back to this holistic sense of 'everything matters'".

Microbiologists have found that hunter-gatherers and Amish people, who work together on farms from childhood, have optimally diverse microbiomes and minimal chances of contracting autoimmune conditions and associated inflammation. Urban westerners who want to boost their more modest skin microbes would benefit from close contact with other people and animals, and from spending as much time as possible in nature, preferably getting dirty.

But now that we are in a pandemic, much of that behaviour is on hold. In fact, if the relative sterility of the world before Covid-19 (in which Hamblin's book was written) was already compromising our microbial balance, lockdowns and social distancing could challenge it even more. "I don't know when we'll go back to handshaking and ways that we might have been sharing different sorts of microbes with one another," says Hamblin.

Of course, reducing antibiotic use is key to microbiome success, along with resisting washing so frequently. Which brings us to bottoms – for this is what people visualise when they get grossed out over other people not soaping themselves. How can you get rid of unwanted residue down there with just your hand and water? "Dry toilet paper kind of creates that problem," says Hamblin. "If you were gardening and had mud all over your hands, would you just use a dry paper towel? No, you'd at least get them wet and scrub them together. When people use bidets, they have less of an issue with that, or when people use disposable towelette things." But the towelettes are expensive, wasteful and block drains, he admits, so "wetting toilet paper is fine". This is his solution, which he shares to satisfy

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curiosity, rather than to preach or prescribe. And no, the paper does not fall apart when wet – “unless you’re trying to drown it”.

theguardian.com, 28 July 2020

<https://www.theguardian.com>

### Does your blood type influence how susceptible you are to covid-19?

2020-07-23

You may have heard that your blood type can protect you against covid-19, or make you more vulnerable. The science suggests that it can do both, a bit, but researchers say that it is too soon to make decisions about personal risk based on your blood group.

The idea that blood type might influence susceptibility to infection by the coronavirus that causes covid-19 began circulating in March after a team led by Jiao Zhao at The Southern University of Science and Technology in China posted some preliminary results online.

Their starting point was the fact that susceptibility to the virus behind SARS is influenced by blood group, with type O somewhat protective against catching the virus. Other viruses are also blood-group dependent; people with type A blood have been found to be more susceptible to hepatitis B and HIV.

The Chinese team blood-typed 2173 people in hospital with covid-19 and compared them with the general population. This revealed that among people in hospital there were more in blood group A and fewer in blood group O than the general population, which suggests type A was associated with a higher risk of infection and type O with a lower risk.

A few weeks later, Michael Zietz and Nicholas Tatonetti at Columbia University Irving Medical Center in New York found a similar pattern, but only among patients whose blood type was rhesus positive (see “What is a blood type?”, below).

The earlier work on the SARS virus had shown that the protection enjoyed by people with type O blood was due to them already having protective antibodies, which may have been created in response to immunogenic molecules, or antigens, from other pathogens. These antibodies inhibited the SARS virus from latching onto a cell receptor called ACE2, which it uses to break into human cells.

**Other viruses are also blood-group dependent; people with type A blood have been found to be more susceptible to hepatitis B and HIV.**

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Those antibodies seen in people with type O blood appear to have been elicited by antigens very similar to those on type A blood cells. This could explain why people in the type A blood group don’t have these antibodies: even if they had been exposed to the same pathogens as those people with type O blood, their immune systems would recognise the antigens as “self”.

Given the biological similarity of the SARS virus and the novel coronavirus, both teams of researchers speculate that the same mechanism is behind the protective effect.

However, susceptibility to infection doesn’t necessarily equate to risk of getting seriously ill. “There are two separate questions,” says Anahita Dua at Massachusetts General Hospital. “Number one, is blood type related to susceptibility to the virus? The second is, once you’ve got it, does your blood type make you have a worse outcome?”

On the second question the evidence is “all over the place”, she says, and mostly in non-peer-reviewed research. The New York team, for example, found no association.

Last month, an international collaboration published a peer-reviewed study of 1590 people from Italy and Spain who had gone into respiratory failure while being treated for covid-19. Researchers scanned the patients’ genomes for variants associated with the severity of their disease and found two.

One was a cluster of six genes with several possible links to the disease, including genes that regulate ACE2; the other was the ABO blood group system. The result is “striking”, says Mark Caulfield at the William Harvey Research Institute in the UK, but needs to be replicated.

The latest peer-reviewed research by Dua’s group hasn’t helped to clear up the confusion. She and her team analysed medical data from thousands of people with covid-19 in the Boston area. “We looked at blood type and severe disease and death, and we found no association,” says her colleague Christopher Latz.

However, says Dua, the association cannot be ruled out and, if it is real, would be a useful tool in assessing patients’ prognoses. “But more research is needed to come to a thorough conclusion,” says Latz.

newscientist.com, 23 July 2020

<https://www.newscientist.com>

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**The future of our food supply**

2020-07-21

If the early days of grocery shopping during coronavirus are remembered for empty shelves and flour hoarding, our present-day food system might be characterized by lines. Lines are a symbol of the burdens of the pandemic, as more people wind down blocks waiting for food aid. They're also a sign of our adaptation, with socially distanced queues of people waiting to enter stores, and separate check-outs for delivery workers buying groceries on behalf of somebody else.

How we get our groceries is a visible stand-in for a food system in flux. As with so many things, we're confronting pre-existing problems that have only been exacerbated by coronavirus, from food accessibility and affordability, to supporting local food suppliers, to improving conditions for the food workforce.

"When we look at the big picture of what's happening I think even within the food industry, this is not new information. It's more of a reveal," said Vivian Barad, managing director at IDEO, a design consulting firm focused on what is known as human-centered design.

CityLab talked to Barad and her colleague Holly Bybee at IDEO's Design for Food Studio about the future of local food systems.

Some changes involve small but essential design tweaks to make our experiences safer, like one-way lanes at the grocery store and freezer door handles you can open with your foot. Many others involve the economic repercussions of delivery's rising popularity.

The focus of our conversation is the behavioral and systemic changes that hint at what comes next: People are buying more food directly from restaurants or farms. Some are becoming distributors within their own neighborhoods of scarce necessities like yeast. Food workers facing spikes in demand and risk are demanding better protections. And while some of us are spending more time in the kitchen baking bread or pickling, others are becoming food insecure and have less time for cooking amid riskier work and limited child care. They would benefit from affordable prepared foods.

Inside the grocery store, the rise in food delivery raises its own set of design questions: What happens when more than half the customers are actually delivery shoppers whose goal is to find products as quickly and efficiently as possible? And as the economy collapses, Barad suggests

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grocers may decide to focus on fewer options, rather than offering 18 kinds of cereal.

"I'm a big believer in the beauty of design constraints anywhere in our lives and I think what we're facing with food are design constraints," said Barad. "People are going to think differently about the whole supply chain versus, you know, just it tastes good."

Below is a transcript of our conversation, edited for length and clarity.

**What has been at the top of your mind in terms of how your own work will shift in the wake of this pandemic, or even during the pandemic?**

**Barad:** What we're seeing is: It's not that the food system is broken. It's doing what it was designed to do — to work super-efficiently to get food to two primary sectors. There's retail and grocery, which is getting food on your table at home, and then there's food service, which is getting food to places like schools and hospitals and restaurants. What we see happening is that one half of that food system shut down. Schools have shut down, people have been sent home from work. That business has seen just an incredible drop. And so this food system, which is so incredibly efficient, is also very specialized. [That specialization] actually makes it fairly rigid and pretty impossible to pivot quickly.

I would add that the food sector generally speaking is now actually having to take a hard look at how it supports or pays or cares for its workers in a way that I think it hasn't had to, because so much has been revealed publicly. Things like the Covid outbreaks in the meatpacking plants, or farmworkers having to try to pick produce in 100-degree heat in PPE wear. Or even just getting your workers to and from a food factory and keeping them safe. I think it's brought up a whole new discussion around that.

This is not a sort of edge-of-the-marketplace question, because the food industry employs something in the neighborhood of 14% of the U.S. workforce and it has the lowest median wage of any industry. I think the figure we've seen is one in six restaurant workers are living in poverty. That's pretty extreme.

**Bybee:** This is the space that we have been thinking the most about when thinking about the future of our food system. Because we have all realized that without these people we would not have food on our tables. And the organizations that are paying them, who are responsible for their care, are themselves pretty vulnerable, like farmers for instance. And so now how does the entire food system begin to collaborate to take responsibility for

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creating the support and the safety nets and the living that these people deserve to be able to continue to do the work?

**Farms have been picking up market share in some places as we're seeing more people buying directly through Community Supported Agriculture-type models. And in some cities, restaurants who had a surplus of food started selling groceries rather than just prepared meals during the pandemic. Do you anticipate continued shifts in food sources? Do you expect that to be perhaps a permanent part of a restaurant's future, or are there other players that you think will come to the fore?**

**Bybee:** On your point about restaurants now selling pantry items: Conversely, we're also seeing small grocers offering to-go prepared meals for families as a way for them to be able to keep all of their staff employed and to be able to also provide better and more services for the communities that they serve. So I think that the link between what is food service and what is food retail is going to get increasingly blurred.

One of the areas that we think is really interesting is a possible future where communities are actually going in on purchasing products together, so using a more community-based collective bargaining to buy products in bulk that they then distribute amongst themselves. We're seeing that around yeast and flour in neighborhoods, where communities were just posting: "Does anybody have flour or yeast?" And then somebody in the community was going and buying flour in bulk because it was the only thing accessible, and then putting it into ziplocs and running it around to the community, selling little pieces of it or giving it away. That's something that we think is potentially going to be a big change for the future in how people purchase and consume their food.

**Barad:** I think the bigger question here is just how people are reconnecting with their regional food systems, and that's a very good thing. It doesn't mean that we don't need the larger global food system. They need to work together. But in communities where there's been no investment in a regional food economy, it's increased the feeling of food insecurity and crisis. I had one person share a story with me that I thought was great. She was talking about other crises that have happened in the U.S., with 9/11 being a great example. During 9/11, when Manhattan shut down all the bridges and tunnels, the government leadership realized that actually it had shut off the food supply and there were only 36 hours' worth of food in Manhattan. And that realization led to a series of conversations and eventually reinvestment in the regional food system. So

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now you have the Hudson River Valley burgeoning with farms, and really lively amazing food markets in the cities.

There's a [great](#) New York Times article that talked about small farmers, who have seen big increases of like 25% to 30% at the weekend farmers' markets. That for me is a really exciting opportunity and I don't see a reason why retailers can't be part of that. I just think they need to think differently about how they're sourcing and where they're getting food from, so that it's not overly reliant on that larger global food system, but also incorporates some of the regional food system. For example, I know I need flour. I know I can go to my bodega, which is half a block away and he's got plenty of flour. But if I go to a Safeway there's nothing on the shelf.

**The example of 9/11 is a great segue to my next question. Any other past instances where food systems have adapted that we can look to now?**

**Barad:** We're really grappling with just the sheer numbers of this economic downturn. We've seen past economic earnings downturns, of course, so that you can look at patterns from that, but recently Feeding America [shared an estimate](#) that there could be 54 million Americans who are food insecure in 2020, which is just a mind-boggling figure. [Editor's Note: A recent UN estimate [projected](#) the pandemic could usher in a dramatic spike in chronic hunger worldwide.] I know in past economic downturns things have adjusted. Things like being able to use food stamps at farmers' markets are a big thing.

**Bybee:** One of the greatest opportunities for design right now is thinking about: How do we include those people who are currently receiving the services in the food system itself? Because they're very much a part of it. We have been designing workarounds to ensure that people can access food who have difficulty accessing it through the current channels. But it's an incredible opportunity to think about: How do we intentionally design for better access for all people to the food they need, versus just basically taking surplus from a system in order to be able to provide for customers of food banks. I think that's a huge opportunity for design at the moment going forward.

**Are there any particular ideas that you see emerging for making food stamps more available at farmers' markets?**

**Bybee:** A lot of farmers are thinking about how to make the transition to regenerative agriculture, and one of the ways to promote the soil health is to use cover crops. We're starting to see some farmers who are planting

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cover crops as food that can serve their community. So as the food or the cover crop is starting to come to fruition, they are enabling the community to come in and access that as a part of creating a much more resilient local food system. One of the other things that we've been seeing, and this is particularly through the work that WWF [World Wildlife Fund] is doing, is the potential of food hubs that exists between farms and food banks, or other places where people will access food. What these hubs can do is to enable secondary processing to extend the shelf life of the crops that are being recovered from farms: Canning, drying, those kind of processes that enable the food to be turned into something else that's still delicious and accessible. So it's a way to be able to extend food life, create a more complex and diverse product mix, and a way to ensure that more food is reaching people who need it.

**Is this a food waste situation, where it's food that would have otherwise not have been eaten by anyone?**

**Bybee:** In some cases it is. In some cases food banks are contracting with farms directly. Raw ingredients are not always the most helpful for families who are trying to feed themselves and work. For instance, we have seen that empty food service kitchens are now being leveraged to be able to take raw ingredients and cook meals for families who need them. So the potential for prepared foods in those kinds of environments is really big.

**Let's take it down to the level of the grocery store. Do you have expectations and observations about how grocery stores will change or adapt?**

**Barad:** Many of our clients and partners have developed e-commerce strategies that they were planning to roll out over sort of a three- to five-year horizon. And in this moment they're having to make it happen in three to five months. It's really a very intense moment from the business side of things and really important to create a strategy for how to meet the demand, and the demand's shifting so quickly to delivery and contactless.

**Holly:** Another thing that we're anticipating because we're starting to see signals is that the grocery shopping experience is likely to be increasingly intermediated. An example is my local farmers' market. It has become impossible for people to pick their own produce from just a public safety standpoint. So now what they're doing is they're creating a way for consumers to be able to go online to pick their produce, and then the people working at the farmers' market in advance of consumers showing up are selecting produce, packaging it and just handing it to them. It's no-touch payment and it's being made to be a lot more efficient. What that

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means is now there are these intermediaries who are picking the produce and putting it together, which is a similar kind of experience to Instacart, for instance.

And then the question becomes: What is the relationship that begins to be built between these intermediaries and the people who are getting us the food? How is the trust built? How do they communicate with each other in new ways so that people still feel connected with their food, while enabling a much more efficient and publicly safe experience?

**From a more prescriptive point of view, what are the changes you think we should be making? To take the farmers' market example you just gave of more intermediaries, for instance, is that even scalable to grocery stores? Should it be?**

**Barad:** I think in order to kind of deliver at that scale for retail, some of the things I would encourage them to be thinking about is there are some clear logistic issues. For example, there was a grocery store here in San Francisco that now has two lines going into the store. One line is for shoppers doing their own shopping. The other is for Instacart. And the Instacart line's been a bit longer than the regular shopper line. But even if you just take those two user groups, they have very very different needs. Where a shopper might be wanting more of an experience in the store, to have it be more sensorial, an Instacart shopper is trying to most efficiently and effectively get the right product for their customer or their client. It's quite a different way to navigate a single space. So how do you design for different modes of use in that space?

We had one of our designers share a great story about how he wanted to buy some wine, so he called a local wine shop and was on Facetime as the owner walked him through selections. You can see there could be a very high-touch version of retail service that might emerge from this which is super different than the current grocery model. I do think that's one of the limitations of Instacart. Especially in this time of bare shelves, there is a real disconnect between what we might see online and what's actually in the store. Another big challenge for retailers is going to be how they use software or some kind of automation to better connect the supply with what people are looking at online. Because there is nothing more disappointing to a shopper than to have a delivery come and it's kind of a random collection of almost what you ordered.

**Bybee:** We anticipate that there will be significant changes in the product mix that's showing up in retail based on how people's lives have changed and therefore, the kind of products that they want to access in that

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environment. For instance, we're not on the go anywhere near the level we used to be and so much of the food merchandising and retailing has been increasingly oriented around convenience and grab-and-go and all of these things that may not be as relevant for a very long time.

You could imagine a world where the brick-and-mortar experience is beneficial for those things that you really want to be able to pick and curate for yourself like produce. The kind of mix of what I want to get into brick-and-mortar and what I can get online may look different.

**Barad:** Retailers have an opportunity to have a really different relationship with consumers, where they might be delivering and using some kind of subscription model, a more bulk or monthly order of a product that could be in a container that gets reused. So they're delivering and then they're doing a return trip with the empties. And that I think gets super interesting because it serves a lot of purposes. For retailers, they can have a more loyal customer base. And then in addition, just the increased efficiency and obviously the improved carbon footprint of going for a subscription model on those kinds of shelf-stable or bulk products. And there are some companies already doing this in this space.

bloomberg.com, 21 July 2020

<https://website>

### How trees can help us fight a pandemic

2020-07-27

Christina Hemphill Fuller is an environmental exposure scientist and epidemiologist focused on the intersection of air pollution, public health, and racial justice. Her expertise has taken on even greater relevance as the Centers for Disease Control and Prevention has confirmed that Black and Latino communities have experienced some of the worst effects of COVID-19, being three times as likely to become infected as white people, and nearly twice as likely to die. The Georgia State University professor says it's not a coincidence that these communities also face more pollution in their daily lives, which makes them more vulnerable to a range of health problems, including lung damage. Fuller's area of specialty is in a type of air pollution called ultrafine particles, which can lodge deep in the lungs and could make people more likely to experience severe effects of COVID-19.

**On the health effects of air pollution:** Air pollution has been known for a long time to be associated with different diseases and conditions linked

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to respiratory disease, but it's also linked to heart attack, heart disease, and lung cancer, in addition to pregnancy outcomes like preterm birth and babies being born early and babies being born smaller.

People who live in places where air pollution is low are more resilient when they're exposed to the virus, and they're less likely to have severe COVID-19.

It's definitely known that air pollution, particularly particulate matter, is associated with poor health outcomes. Air pollution many times concerns PM2.5—particulate matter as less than 2.5 microns in diameter—and also ozone. And both of those are regulated by the Clean Air Act.

**On why Black people are disproportionately affected:** There are many studies that have documented that communities with more Blacks or Hispanics have higher air pollution, and that's because industries are placed there on purpose. The first study to talk about that was *Toxic Waste and Race, way back in 1987*, and updated in 2007. This study looked at hazardous waste facilities all around the country and found that the most important predictor was race, and the second was income.

There are some differences between urban communities and rural communities. One that's really important that I study a lot is traffic. Definitely in urban communities a lot of air pollution that we're concerned about comes from traffic. So being close to a highway or major roads that has lots of cars and trucks on it, you're going to have high air pollution exposure. A lot of the times those run through communities of color, leading to high air pollution exposures in those neighborhoods.

In addition to that, we have our energy production, so natural gas and coal-fired power plants are also disproportionately in communities of color and low-income communities. There are other types of industries, like a car body shop and dry cleaners, that are smaller producers, but they do produce air pollution and those are also disproportionately in color or low-income communities.

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In rural areas, traffic may be less of an issue, but you have other types of industry and power generation still disproportionately in communities of color.

**On the challenges of pinning down the impact of air pollution in a pandemic:** If you were to do a search for air pollution and heart disease, or air pollution and respiratory disease, you will find thousands and

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thousands of studies. But if you look at whether air pollution makes you *susceptible*, and that's what the field of public health calls "effect modification," you're going to find maybe tens, twenties of those.

Let's pick PM2.5, because PM2.5 is widely studied. We'll do a study and record what the PM2.5 levels are, and then you'll look at how many people die from a heart attack, how many people get a particular respiratory disease, or how many people get lung cancer due to that exposure. We can really say that exposure to particulate matter is related to development of asthma, because there's just so much data.

The research that I've been doing is people who are under high stress. So if you are under high stress and you're exposed to air pollution, you have an even higher risk of heart disease. That's putting two effects together.

For COVID-19 there are a couple of studies that have come out—one is the Harvard study by [Dr. Francesca Dominici of Harvard](#): If you have high exposure to air pollution, is that going to increase your risk of contracting COVID 19 and having worse outcomes?

What we're concerned about is susceptibility: When your lungs already damaged by having chronic exposure to particulate matter, then you're going to be more susceptible to other diseases versus if you were just exposed to that disease, and your lungs weren't already damaged.

People who are living in areas where the air pollution is high already had damage and they actually are having worse health outcomes versus people who live in places where air pollution is low, who are more resilient when they're exposed to the virus and they're less likely to have severe COVID-19.

**On the problem of ultrafine particles:** Air pollution is such a mix of chemicals, and we only monitor for a few, and then we regulate for even fewer. Particulate matter are either solid or liquid droplets suspended in air and we regulate for those that are smaller than 2.5 microns, and smaller than 10 microns. The EPA monitors for PM2.5 and PM10.

The Clean Air Act is wonderful and has led to many positive changes, but the EPA still may not tell you what's outside of your house.

But a particular one that I study is called ultrafine particles, and those are less than 100 nanometers in diameter. There is no regulation around that. Over recent years, the studies have shown that ultrafine particles are really, really important for public health. And you have to measure for them specifically.

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If you put a PM2.5 monitor next to a busy highway, you're not going to detect the really small particles. You'd have to monitor those specifically and those are really high next to roads.

They potentially are more damaging than PM2.5, because they are very small. They have a lot of surface area where lots of other chemicals can stick to. And then they can go down deeply into your lungs all the way where you actually have the gas exchange between oxygen and the air to your body. So they can get very deep into your lungs and causing damage there is a lot worse than causing damage in the upper airways.

If you count the number of particles that are in urban air, about 90 percent of them are going to be ultrafine particles. They've been linked to heart disease, cancer, asthma, other respiratory diseases, Chronic Obstructive Pulmonary Disease, and preterm birth. And they're not being captured right now in our regulatory system.

**On the big changes our leaders could make to cut pollution before the next pandemic:** We need to maintain and strengthen our environmental laws and regulations: Over 100 regulations have been rolled back in the last three years. We need to have our elected officials stop permitting these facilities to be in communities color, and to be highly concentrated. If you map these polluting facilities, they are clumped up in different areas, and those areas are low income communities of color. We know that there's an issue, but we've got to do something about it.

In relation to the built environment, we can change how we design our cities, as more of us are moving into cities. We should have cleaner buildings, achieving zero carbon or as close to that as possible, buildings that are energy efficient, and buildings that have green roofs. There are places in Europe and in other countries that are having car-free days, making different roadways into pedestrian-only and doing more to encourage biking and walking. Those are structural things that need to be done.

**A few cool hacks we can use in the meantime:** There are more tools people can use to understand pollution in their neighborhoods. If you make it really personal to them, they are more likely to support changes.

Usually when they're picking sites for compliance with the Clean Air Act, they're putting monitors in what we call urban background locations. Those are locations that are far away from some of the major sources, so it's going to be the lowest concentration in the urban setting.

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There are some lower-cost air pollution monitors that do a pretty good job of measuring air pollution. People can buy them for a couple hundred dollars and see what it is by their house. The Clean Air Act is wonderful and has led to many positive changes, but the EPA still may not tell you what's outside of *your* house. And so if we're able to get more people monitoring outside of their houses, then they will have more knowledge about what air pollution is. That's really important for communities of color that are already have really high air pollution. They can show their elected officials, "Hey, the pollution here is really bad. And it's affecting us: our asthma rates are high."

We really need to empower people to have knowledge and to advocate for themselves. That's really important.

With traffic pollution, in particular, in areas where we can't necessarily remove a highway, we could reduce the impact that it has on the neighboring communities by putting in a barrier of trees there. It's not only that green environments are wonderful for mental health, but they also can reduce the pollution that is coming off that roadway and affecting people who live next to it. There's thousands of schools across the country that are right next to highways, and kids are playing outside next to the road. But if we're able to put something there like a tree barrier, they actually have been shown to reduce pollution. That's a study that I'm doing right now figuring out in the southeast, in Atlanta in particular, what that can look like to get the most benefit.

[motherjones.com](https://www.motherjones.com), 27 July 2020

<https://www.motherjones.com>

### **From rocks to icebergs, the natural world tends to break into cubes**

2020-07-27

Perhaps the Cubists were right. Researchers have found that when everything from icebergs to rocks breaks apart, their pieces tend to resemble cubes. The finding suggests a universal rule of fragmentation at scales ranging from the microscopic to the planetary.

"It's a very beautiful combination of pure mathematics, materials science, and geology," says Sujit Datta, a chemical and biological engineer at Princeton University who was not involved in the work.

**The finding suggests a universal rule of fragmentation at scales ranging from the microscopic to the planetary.**

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The finding builds on the previous work of mathematician Gábor Domokos of Budapest University of Technology and Economics, who in 2006 helped prove the existence of the gömböc, a gemstonelike shape that has only one stable balance point. Set a gömböc down on a table, and it will always come to rest in the exact same position, unlike, say, a cylinder, which can rest on its end or its side. In subsequent work, Domokos and his colleagues found that entities such as pebbles washing downriver and sand grains blowing in the wind tend to erode toward gömböcish shapes without ever achieving that ideal. "The gömböc is part of nature, but only as a dream," Domokos says.

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He and his team then turned to the other side of this process—how rocks themselves are born. They started their study "fragmenting" an abstract cube in a computer simulation by slicing it with 50 2D planes inserted at random angles. The planes cut the cube into 600,000 fragments, which were, on average, cubic themselves—meaning that, on average, the fragments had six sides that were quadrangles, although any individual fragment need not be a cube. The result led the researchers to suspect that cubes might be a common feature of fragmentation.

The researchers tried to confirm this hunch using real-world measurements. They headed to an outcrop of the mineral dolomite on the mountain Hármashatárhegy in Budapest, Hungary, and counted the number of vertices in cracks in the stone face. Most of these cracks formed squarish shapes, which is one of the faces of a cube, regardless of whether they had been weathered naturally or had been created by humans dynamiting the mountain.

Finally, the team created more powerful supercomputer simulations modeling the breakup of 3D materials under idealized conditions—like a rock being pulled equally in all directions. Such cases formed polyhedral pieces that were, in an average sense, cubes, the researchers report this week in the *Proceedings of the National Academy of Sciences*.

Skeptics might point out that many things in the natural world don't fragment into cubes. Minerals such as mica, for instance, come off in flakes, whereas basaltic formations including the Giant's Causeway in Northern Ireland break into hexagonal columns.

That's because real materials are not like the idealized forms found in the team's simulations, says Douglas Jerolmack, a geophysicist at the University of Pennsylvania and co-author of the paper. They usually

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contain interior structures or properties that favor noncubic breakages. For example, mica flakes because it is weaker in one direction than in the perpendicular directions. “But in a statistical averaged sense, rocks are born as something that’s a vague shadow of a cube,” Jerolmack says. The findings, he adds, could help hydrologists predict fluid flow through cracks in the ground for oil extraction, or help geologists calculate the sizes of hazardous rocks breaking off cliff faces.

Some find the study a bit difficult to parse, however. “You need to have this abstract theoretical view of earth surface processes to really dig into what this can mean,” says Anne Voigtländer, a geologist at the GFZ German Research Centre for Geosciences. “It’s sometimes hard for geologists to understand the value of it, or to see where it applies.”

Jerolmack agrees that, in some sense, the result is more philosophical than scientific. He notes that his team took inspiration from the Greek philosopher Plato, who related each of the four classical elements—earth, air, fire, and water—to a regular polyhedron, coincidentally linking earth with the cube. But Plato is more remembered for his allegory of the cave, in which he speculated about certain idealized and eternal forms, of which only garbled versions existed in the real world. “With the naked eye you see distorted images—the fragments,” Domokos says. “But in order to see the ideal, you have to use your mind.”

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sciencemag.org, 27 July 2020

<https://www.sciencemag.org>

### Inside clean energy: How soon will an EV cost the same as a gasoline vehicle? Sooner than you think

2020-07-30

At some point, probably sooner than you expect, the price of an all-electric vehicle will fall far enough to equal the cost of an equivalent gasoline vehicle.

We know that day is coming and a whole lot of people—many of whom work in the auto industry—would like to know when.

So here’s an answer: Maybe by 2023, probably by 2024 and almost definitely by 2025.

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That’s according to Venkat Viswanathan and his team of researchers at Carnegie Mellon University in Pittsburgh. They developed a model to calculate the costs of EV batteries that breaks down the costs of each component and then predicts changes over time.

“There will definitely be cars, passenger vehicles, in multiple segments where the EV option is the cheaper option,” Viswanathan said about the 2025 timeframe.

When we talk about the cost of EVs, we’re mainly talking about the cost of batteries, which are the most expensive components in the vehicle, and also the ones for which the costs are changing most quickly.

Analysts and researchers have said for years that a battery price of \$100 per kilowatt-hour is the point at which EVs become cost-competitive with gasoline vehicles. Last year, the global average price was down to \$156 per kilowatt-hour, according to BloombergNEF.

But the model developed by Viswanathan and his colleagues shows that battery packs are on track to cost less than \$80 per kilowatt-hour by 2025, a projection in line with leading forecasts, like that from BloombergNEF (You can read more about their model in a 2017 [journal article](#) and in a [recent post](#) on The Conversation).

Now that the below-\$100 benchmark is within sight, it’s important to specify what it means. It doesn’t mean that I can go out and buy an EV of any size and it will cost the same or less than it would for a gasoline model with similar features. But it probably does mean that I will be able to get a compact sedan EV for about the same cost and with similar features as one that runs on gasoline.

Viswanathan said cost parity will arrive first for small sedans that now sell for \$30,000 or less. It will take longer for automakers to develop electric trucks and SUVs that cost about the same as similar gasoline models.

One of the big reasons we will need to wait longer for larger vehicles is that trucks and SUVs need a lot of power for towing capacity, which means larger battery packs and higher costs.

The fact that EVs will be cost-competitive should help to transform a market in which less than 2 percent of new vehicles sold are all-electric.

This change is coming, and it’s coming fast, and that’s good news for the climate because transportation is responsible for more than a quarter of U.S. emissions.

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## Electric Trucks Are Coming, with Chevy Entering the Fray

Most of the EVs on the market today are sedans, even though U.S. consumers prefer, by a wide margin, crossovers, trucks and SUVs.

Automakers know that for EVs to truly reach the mainstream, there will need to be attractive options in all of those classes, which is why several of the biggest players are racing to develop all-electric pickups.

General Motors said last week that it will begin selling an all-electric Chevrolet pickup by 2025. This will follow the company's release of the GMC Hummer EV, a pickup that could go on sale as soon as next year.

Those models will be part of a competitive landscape that also includes the Ford F-150 EV, the Tesla Cybertruck and the Rivian R1T, all of which are heading for rollouts over the next two years.

Stephanie Brinley, an auto analyst for IHS Markit, told me that automakers are developing electric trucks not because they expect to sell a lot of them in the near future, but because they need to have strong electric options across their lineups in the long run.

"You can't wait until 2040 and go, 'Oh, now we'll just drop the battery in here,'" she said. "The vehicle needs are too complicated, so you have to start developing it much earlier."

Her company is projecting that all-electric trucks will be 0.87 percent of U.S. sales of cars and light trucks in 2025, and that EVs in general will be about 8 percent of sales.

One of the big questions about electric trucks is which regions will emerge as centers of customer demand. Brinley said she is looking to Texas as a possibility because the state is the leading market for pickup trucks. California is also likely to have a big role to play, she said.

But even in those places that have demand for electric trucks, that demand is likely to be low.

"We're really in baby stages," Brinley said of building the foundation of the market to come. "It's not about how many you sell in 2024. It's about how many you sell in 2035."

## Federal Review of Vineyard Wind Isn't Moving Quickly, But It's Moving

Monday was the deadline for interested parties to comment in the federal government's long-delayed process of reviewing whether to approve a

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permit for Vineyard Wind 1 off of the Massachusetts coast, which, at 800 megawatts, would be the first giant-size offshore wind farm in the country.

The new round of comments includes a lot of talk about "transit lanes" for fishing boats. But before I get to that, some background:

The companies behind Vineyard Wind 1 had hoped to begin construction last year, but President Trump's Bureau of Ocean Energy Management dashed those plans last summer by taking the unusual step of pausing and expanding the process of reviewing the environmental implications of the project.

Last month, the bureau issued a long-awaited supplement to the project's draft environmental impact statement, which some see as a sign of forward progress. The bureau's current timetable calls for a decision before the end of the year.

But this new document includes a potential redesign of the project layout suggested by a fishing industry group. This alternative design would require a "transit lane" of up to four miles that would go through the project area and could not have any wind turbines. The project's developers and clean energy industry groups say that doesn't make sense.

In this latest round of comments, renewable energy industry groups are highlighting the economic benefits of offshore wind and saying that the transit lane proposal is unnecessary.

On the other side, fishing industry groups, including the one that suggested the transit lane, Responsible Offshore Development Alliance, continued to raise concerns that the process has not adequately accounted for the potential harm to fishing and other industries dependent on the ocean.

I asked Brandon Burke, director of policy and outreach at the Business Network for Offshore Wind, to help me understand where things stand.

He said that the transit lanes proposal is not a "poison pill," but that it would harm the project by reducing the amount of space available for turbines, which would reduce the amount of electricity that could be generated.

This is bigger than just Vineyard Wind 1, he said, because the fishing industry group is asking for transit lanes that would extend through many other potential offshore wind projects in the area.

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Whenever I write about Vineyard Wind 1, it's important to take a few steps back to explain why this is so important. The country now has two offshore wind farms in operation, off the coasts of Rhode Island and Virginia, that have a capacity of 30 megawatts and 12 megawatts, respectively.

Vineyard Wind 1 would be the first offshore wind project in the United States to operate on a much larger scale. Once it is up and running, there are many other proposed projects that could follow and are in various stages of planning all along the East Coast, with discussions underway for the West Coast, as well.

If Vineyard Wind 1 is delayed and modified so much that it turns into a nightmare for all involved, that would be a bad omen for the entire offshore wind industry.

But the federal review also could be a good thing if it helps the government learn how to effectively handle other large offshore projects, and helps developers figure out how they can craft proposals in ways that will minimize delays.

I'll continue to follow this and let you know what happens.

[insideclimatenews.org](https://www.insideclimatenews.org), 30 July 2020

<https://www.insideclimatenews.org>

### **Migratory fish populations plunge 76% in past 50 years** 2020-07-28

Populations of migratory river fish around the world have plunged by a "catastrophic" 76% since 1970, [an analysis](#) has found.

The fall was even greater in Europe at 93%, and for some groups of fish, with sturgeon and eel populations both down by more than 90%.

Species such as salmon, trout and giant catfish are vital not just to the rivers and lakes in which they breed or feed but to entire ecosystems. By swimming upstream, they transport nutrients from the oceans and provide food for many land animals, including bears, wolves and birds of prey.

The migratory fish are also critical for the food security and livelihoods of millions of people around the world, while recreational fishing is worth billions of dollars a year. The causes of the decline are the hundreds of thousands of dams around the world, overfishing, the climate crisis and water pollution.

**The fall was even greater in Europe at 93%, and for some groups of fish, with sturgeon and eel populations both down by more than 90%.**

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The scientists said the situation may be even bleaker than it seemed, as many declines began before 1970. Populations of sturgeon in the Great Lakes of North America, for example, have dropped by 95% from historic levels. Furthermore, suitable data has not been gathered on species in some of the world's most biodiverse rivers such as the Mekong, Congo, Amazon and Yangtze, where researchers fear there will be hundreds of fish extinctions in the coming decades.

The average fall in populations was 84% in Latin America, while there has been a 59% decrease in Asia-Oceania, although there is limited data there and not enough from Africa to determine any reliable trend. In North America, the fall was less dramatic, at 28%. This is probably because large declines occurred before 1970, but also as a result of a growing number of dams being removed.

"For migratory fish, there's nothing worse than a dam," said Zeb Hogan, at the University of Nevada and an author of the new report. He said the good news was that fish could return quickly: "Almost without exception, where dams have been removed, you see populations bounce back, often much more quickly than anyone anticipated."

A river restoration completed by the Penobscot River Restoration Trust partners in 2016 on the Penobscot River in Maine, US, led to river herring numbers growing from a few hundred to nearly 2m a year. The [Dam Removal Europe](#) coalition is working to free the continent's rivers from more than 100,000 obsolete barriers. But thousands of hydropower dams are being built in other parts of the world.

"Catastrophic losses in migratory fish populations show we cannot continue destroying our rivers," said Arjan Berkhuisen, at the World [Fish Migration Foundation](#). "This has immense consequences for people and nature across the globe. We can and need to act now before these keystone species are lost for good."

Michelle Jackson, at the University of Oxford, UK, who was not involved in the report, said: "The population declines are certainly very drastic, but I am not surprised. The outlook gets worse each time [there is a new report]."

She said migratory fish were often the driving force in food chains because they transport nutrients: "If these fish populations continue to decline, there will be far-reaching consequences for many species which rely on them."

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The decline in migratory fish populations is higher than that for land and ocean animals, whose populations have fallen by an average of 60% in the last 50 years. “Freshwaters are disproportionately at risk to human pressures, since they are affected by everything happening in the surrounding catchment,” said Jackson.

Previous research by Hogan found many giant river fish are on the verge of extinction, with populations from catfish to stingrays down by 97% since 1970. Other studies have shown only a third of world’s great rivers remain free-flowing, while in Britain, for example, 97% of the river network has been interrupted by human-built structures.

The report, led by Stefanie Deinet at the Zoological Society of London, examined data from 1,406 populations of 247 species. There are 1,100 species that must migrate to survive. The researchers said much more data was needed for regions outside Europe and North America to go beyond the general trends presented in the report.

The analysis did show management plans for rivers and fishing helped curb the losses, with populations down 54% in such circumstances, compared with 87% for those that were unmanaged.

Migratory fish often use water temperature as a cue to start their journeys, but dams can significantly lower the temperature of river water. Global heating is also a factor, and can also change rainfall patterns. “So you get these very unnatural flows that can really have an impact on migratory fish,” said Hogan.

“Not all dams are created equal,” he added. “Some dams are more environmentally damaging than others and how you place, design and operate them is important.” The damage to ecosystems and livelihoods must be taken more into account when building new dams, he said.

Stephanie Januchowski-Hartley, at Swansea University, UK, said the millions of small obstructions to rivers, such as road culverts, also needed to be considered: “The cumulative effects of those are potentially greater than that of larger infrastructure, because of sheer numbers in the waterscape.”

“We know why we’re losing these fish and we know what to do to save or restore them,” Hogan said. “It’s now a matter of public awareness and

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public will.” Stuart Orr, at WWF, said: “The world needs to implement an emergency recovery plan for the benefit of people and nature.”

theguardian.com, 28 July 2020

<https://website>

### What could drive humans to extinction?

2020-07-29

We all have been watching post-apocalyptic films, which tells the story of a catastrophe — an asteroid strike perhaps, or a nuclear war — that causes humanity’s demise, and then follows the challenge of remaining humans trying to save their species from extinction.

But what if human extinction is a looming reality? In fact, researchers around the world spend their days grappling with this very possibility, and how we might avoid it.

There are multiple theories around what might ultimately cause human extinction — everything from alien invasions to catastrophic asteroid strikes. But there’s a general consensus that some risks to human life are more plausible than others. Researchers have named them ‘existential risks’. An existential risk is not a regular hazard or threat. It’s the vulnerability is our inability to stop it from occurring and our exposure to that hazard.

#### Nuclear war

It is one of the biggest potential risks to human survival. This threat grows if countries produce highly-enriched uranium, and as political tensions between nations escalate. The risks are the effects of a large-scale nuclear winter — the period of freezing temperatures and limited food production that would follow a war, caused by a nuclear haze blocking sunlight from reaching the Earth — would be profound.

#### Pandemics

The misuse of biotechnology is another existential risk that keeps researchers up at night. One of the particular concerns is the abuse of biotechnology to engineer deadly, quick-spreading pathogens.

#### Climate change

Climate change — a phenomenon that’s already driving the decline and extinction of multiple species across the planet. The accompaniments to

**But what if human extinction is a looming reality? In fact, researchers around the world spend their days grappling with this very possibility, and how we might avoid it.**

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climate change — food insecurity, water scarcity, and extreme weather events — are set to increasingly threaten human survival, at regional scales. Imagine: food or water scarcity intensifying international tensions, and triggering nuclear wars with potentially enormous human fatalities.

### Artificial Intelligence

Researchers philosophise that intelligent robots, unintentionally unleashed on the world, might impose widespread surveillance on humans, or outpace us physically and mentally.

### Humanity itself

However wide-ranging these risks are, they all have one thing in common: humans play a key role in determining the severity of these risks. So what if humans are their own biggest extinction risk? Looking at past civilisations including the Roman Empire and Easter Island, the majority of existential risks are self-created, rooted in societies and the systems they produce.

telanganatoday.com, 29 July 2020

<https://www.telanganatoday.com>

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## Technical Notes

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### CHEMICAL EFFECTS

[Impact of surface functionalization on the toxicity and antimicrobial effects of selenium nanoparticles considering different routes of entry](#)

[Effect Modelling Quantifies the Difference Between the Toxicity of Average Pesticide Concentrations and Time-variable Exposures from Water Quality Monitoring](#)

[Organic and conventional agriculture: Conventional rice farming causes biochemical changes in \*Astyanax lacustris\*](#)

### ENVIRONMENTAL RESEARCH

[Chromium Pollution in European Water, Sources, Health Risk, and Remediation Strategies: An Overview](#)

[Emerging Pollutants - Part II: Treatment](#)

[Associations between acute exposure to ambient air pollution and length of stay for inpatients with ischemic heart disease: a multi-city analysis in central China](#)

### OCCUPATIONAL

[Heavy metals and the skin: sensitization patterns in Lithuanian metalworkers](#)

[Polymorphism in GSTM1 and GSTT1 genes influence DNA damage in personnel occupationally exposed to volatile anaesthetics \(VA\), from Peshawar, Pakistan](#)

### PHARMACEUTICAL/TOXICOLOGY

[Effect of prenatal exposure to per- and polyfluoroalkyl substances on childhood allergies and common infectious diseases in children up to age 7 years: The Hokkaido study on environment and children's health](#)

[Effect of lifetime antiepileptic drug treatment history on efficacy and tolerability of adjunctive brivaracetam in adults with focal seizures: Post-hoc analysis of a randomized, placebo-controlled trial](#)