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

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Regulatory Update

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ASIA PACIFIC

Japan considers extension to PFOA ban

2020-04-16

Japan's government is considering allowing some exemptions from the upcoming ban on the use of perfluorooctanoic acid (PFOA) and its related compounds, in response to industry feedback.

The ban was due to come into force in April this year, but the Ministry of Health, Labour and Welfare (MHLW) delayed the start date, citing comments from a public consultation that closed in late 2019.

The government has now restated its intention to reclassify PFOA and its compounds as Class 1 specified substances by 3 December 2020.

This class of chemicals is effectively banned from manufacture and import because of their persistent, bioaccumulative and toxic effects.

The new ban date coincides with the implementation of amendments to the Stockholm Convention, which oblige Japan and other signatory countries to stop using PFOA except in certain listed applications with no available substitutes.

New exemptions for PFOA

The original proposal allowed manufacturers to continue using PFOA in certain pharmaceutical applications. But industry has called for additional exemptions to allow its use in photoresists for the semiconductor industry and in invasive and implantable medical devices. The government is now considering allowing these uses.

Feedback also highlighted uncertainty among industry and consumer groups over how the ban will apply to polytetrafluoroethylene (PTFE, also known by the trade name Teflon) and other products that might degrade to form PFOA as a byproduct.

In response to NGO calls for frying pans and waterproofing sprays to require labels indicating the products contain PFOA, the government said this should not be necessary if the substance is effectively eliminated as a byproduct. But it said it would revisit the subject at a later date.

Manufacturers and users of PTFE micropowders expressed concerns about the small amounts of PFOA that are produced during manufacture and whether this would make the materials subject to ban. PTFE micropowders

This class of chemicals is effectively banned from manufacture and import because of their persistent, bioaccumulative and toxic effects.

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are widely used in printing inks, coatings, paints, elastomers and lubricants.

The government has said that PFOA produced as a byproduct will not be treated as a Class 1 specified substance if adequate measures are taken to reduce its levels.

Need for limits

Other comments point to the need for a standard on PFOA to outline the maximum amount in a mixture that would see the mixture controlled as a Class 1 specified substance. The EU's REACH regulation sets a limit for trace contamination of 25 parts per billion, but NGOs have argued that this limit is too high. The Japanese government has deferred setting a similar limit, citing a lack of agreement on a standard value under the Stockholm Convention.

Instead, the government refers to the Ministry of Economy, Trade and Industry (Meti) guidance on handling chemical substances containing byproduct Class I specified chemical substances. Companies that become aware of small amounts of a Class 1 specified substance in their products through analysis must immediately set a provisional upper limit for voluntary control and report measures to reduce its content to the government. Relevant documents should be submitted to the Ministry of Health, Labour and Welfare, Meti and the environment ministry for further consideration.

The ministries are now accepting submissions of documents related to PFOA ahead of its reclassification.

Proposed timeline

- after June 2020 – public consultation on the draft law;
- December 2020 – designation of the substances as Class I specified chemical substances; and
- after December 2020 – restrictions expected to be implemented.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108006/japan-considers-exemptions-to-pfoa-ban#overlay-strip>

22 October 2019

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Thailand launches hazardous substance licensing tool

2020-04-16

Thailand's Department of Industrial Works (DIW) has launched an online hazardous substance single submission (HSSS) tool to help companies more quickly obtain licences to use type 3 hazardous substances.

When the tool is fully operational, companies will be able to submit the documents required online, said Piyatida Pukclai, Asia Pacific regulatory policy director at consultancy knoell. Type 3 substances are those that present a higher degree of hazard.

"Companies will no longer need to collect a physical copy of the licence from the DIW office," Dr Pukclai added.

When the tool is complete, the authorities will turn their focus to the development of the country's chemical inventory.

"Although the authorities planned to focus on the inventory this year, due to the outbreak of coronavirus Covid-19, the budget for this year might be reallocated to other purposes, so it is unclear when they will complete it," said Dr Pukclai.

Thailand currently only has a preliminary existing chemicals inventory in place, containing around 16,000 substances. While it has been online since 2016, the final version has been delayed for many years.

Completing the inventory is essential to the development of the new national chemicals law, said Dr Pukclai.

"The hazardous substance team from the existing Hazardous Substance Act is working in parallel with the chemical law team from the proposed new Act on the development of the inventory," she added.

When the inventory is complete, companies will be able to use the HSSS tool to search it.

Delays to chemical law

Meanwhile, progress on the country's draft chemical law has been delayed due to the coronavirus Covid-19, the Food and Drug Administration (FDA)'s Yaowares Oppamayun told Chemical Watch.

Thailand's National Committee on Chemical Management Policy is now set to consider a second draft of the proposed new chemical law in July.

Thailand currently only has a preliminary existing chemicals inventory in place, containing around 16,000 substances.

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“Initially, the draft was planned to be placed before the Committee at the end of last year or early this year, but due to the situation with coronavirus, it has been postponed until July,” said Ms Oppamayun.

If the National Committee approves the draft, it will move to the Cabinet. At this point, the Cabinet could make additional revisions and conduct further public hearings before it is passed to parliament to be considered and passed into law.

“Because of the delays arising from the virus, it is unlikely that the draft will be fully approved this year but the FDA is hoping it will be completed for implementation next year,” said Ms Oppamayun.

After the law is approved, there will be a 180 day transition period.

“We are currently also developing the details on the creation of the national chemical agency and we’re in discussion over which ministry the agency will sit under. The detailed proposal will be put to the national committee at the July meeting,” said Ms Oppamayun.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108007/thailand-launches-hazardous-substance-licensing-tool>

Vietnam Updates the List of Banned and Restricted Active Ingredients in Insecticide and Disinfectant

2020-04-10

The List of active ingredients banned from use and restricted in the scope of use in household and public health insecticides and disinfectants is promulgated in the draft Circular.

The draft Circular is scheduled for adoption in June and will finally enter into effect on August 1, 2020, and replace the previous Circular No.47/2017/TT-BYT immediately.

On March 19, 2020, the World Trade Organization (WTO) issued a Notification [1] to solicit comments from members on Vietnam’s draft Circular [2] which promulgated the List of active ingredients banned from use and restricting the scope of insecticide and disinfectant registration for household and medical use. According to the Notification, the

The draft Circular is scheduled for adoption in June and will finally enter into effect on August 1, 2020, and replace the previous Circular No.47/2017/TT-BYT immediately.

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consultation will last for 60 days, and the draft Circular is scheduled for adoption in June and will finally enter in force on August 1.

Chemlinked, 10 April 2020

<https://chemical.chemlinked.com/news/chemical-news/vietnam-updates-the-list-of-banned-and-restricted-active-ingredients-in-insecticide-and-disinfectant>

AMERICA

Mexico to tackle lead in glazed pottery, other consumer products

2020-04-16

Mexico is set to publish a revised standard on lead in glazed pottery this year, as part of a plan to control the toxic metal's presence in consumer products.

Pottery in Mexico is typically fired at low temperatures and coated with a glaze made of lead and other minerals. Lead has been the preferred choice for artisanal potters for centuries, because it will fuse at much lower temperatures than alternatives require.

The negative health effects of this practice were highlighted in a 2017 study, which found that around 200 micrograms per litre ($\mu\text{g}/\text{L}$) of lead leached from pottery into the food and water cooked and stored within it. The US banned pottery imports from Mexico that aren't labelled 'lead-free' two decades ago.

But despite efforts by NGOs and the government to encourage lead-free substitutes, pottery has been flagged in the Mexican health authority's national chemicals policy proposal as "one of the [population's] main sources of exposure to this heavy metal".

The health authority says "research currently available nationwide" estimates that one million Mexican children under the age of five have lead poisoning, according to the health authority. This equates to one in 11 children under five in the country.

Enforcement challenges

The 2016 standard on glazed pottery currently in place sets maximum migration limits for lead, ranging from 2 milligrams per litre (2mg/L) for

Pottery in Mexico is typically fired at low temperatures and coated with a glaze made of lead and other minerals.

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small hollow jars to 0.5 mg/L for pieces that will come into contact with food or drinks.

But this standard is “useless and ineffective”, according to Sofia Chávez Arce, director of the NGO Casa CEM, because it sets migration limits instead of total lead content limits, which “might” protect the end user, but won’t help the workers involved in manufacturing, or their families and surrounding communities. Additionally, with tens of thousands of artisanal family pottery shops in the country, “surveillance is impossible”.

The government is also battling with a long-established tradition. It has tried to promote a boron-based alternative to the lead glaze, but many potters still prefer lead.

The health authority’s proposal did not outline what its new standard or law will look like, but said it expects to publish it this year. Ms Chávez says it should set limits for total lead content in pottery instead of migration limits, and it should address the lead oxide supply chain that supplies the trade.

‘Confusing’ standards

Several different standards regulate lead in consumer products in Mexico (see box), but there is no overarching law or regulation.

“I think all lead limit standards should be reviewed for inconsistencies ... and set into one comprehensive law,” Ms Chávez said. “As of now they are very confusing, some [are] obsolete and some contradictory.”

A lack of surveillance and enforcement are also massive problems, she added.

Pottery is the health authority’s first priority, followed by updating standards on lead paint used in children’s toys and games and then paint used in homes, according to its proposal.

The proposal also sets out plans for a national chemicals law that would place the burden of proof on companies to show substances they import or use in the country are safe, and would allow the government to restrict or ban those that pose an “unacceptable risk”.

Lead in consumer products

A number of Mexican standards have been set for lead in consumer products in recent years, including:

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- NOM-003-SSA1-2006, published 4 August 2010: prohibits paints with a lead content higher than 600 parts per million (ppm), and sets out labelling requirements for leaded paints;
- NOM-252-SSA1-2011, published 15 May 2012: sets migration limit of 90 mg/kg for lead in toys and school supplies, as well as limits for other heavy metals;
- NOM-004-SSA1-2013, published 2 May 2014: says the use of lead compounds “should be avoided” in paints, coatings, inks, glazed pottery and cosmetics.
- NOM-231-SSA1-2016, published 25 October 2016: sets migration limits for lead and cadmium in pottery. For lead, limits range from 2 mg/L for flat pieces and small hollow jars to 0.5 mg/L for pieces that will come into contact with food or drinks.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108070/mexico-to-tackle-lead-in-glazed-pottery-other-consumer-products>

New analysis finds sites owned by Waste Management and others could be discharging PFAS

2020-04-17

New analysis from the Environmental Working Group (EWG) argues that a number of landfills and other waste sites could be discharging toxic “forever chemicals” into the air and water. The environmental advocacy organization looked at more than 2,500 industrial facilities across the country as part of its research on per- and polyfluoroalkyl substances (PFAS).

Included in the more than 30 sites listed by the group are facilities operated by Waste Management, Republic Services, Clean Harbors, Veolia North America, US Ecology and Illinois-based Peoria Disposal Co. (PDC), among others. “We disagree with any suggestion in the report that the Waste Management landfills present any threat to public health or the environment,” Janette Micelli, a spokesperson for the company, told Waste Dive.

The report’s findings are only “suspected” and do not firmly establish those facilities as confirmed sources of PFAS. EWG asserts a lack of oversight and mandated testing by the U.S. EPA has limited available data on PFAS sources. Lawmakers supportive of regulating PFAS argued in a call last

The report’s findings are only “suspected” and do not firmly establish those facilities as confirmed sources of PFAS.

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week that the COVID-19 pandemic has underscored the importance of public health, potentially generating more oversight from Congress.

Waste Dive, 17 April 2020

<https://www.wastedive.com/news/pfas-study-ewg-waste-management-veolia-contamination-coronavirus/575889/>

EPA issues guidance for cleanups during Coronavirus crisis

2020-04-13

Cleanups of polluted sites across the nation may be suspended if workers get sick with COVID-19, can't maintain proper social distancing or face a host of other coronavirus-related factors, the U.S. Environmental Protection Agency said Friday.

In an effort to create a nationally consistent decision-making process for regulators overseeing Superfund sites and other types of cleanups, the EPA issued guidance Friday to all its regional offices with instructions about when a cleanup effort should be shut down.

The EPA recently said that this type of cleanup work is considered "essential" and that it has continued to respond to environmental emergencies at Superfund sites, risk management program facilities, facility response plan facilities, or in situations where the agency "is called upon to protect human health and the environment from the releases of chemical, oil, radiological, biological and other hazardous materials."

The EPA said that work can be reduced or suspended at sites if:

- State, tribal or local health officials have requested a stoppage.
- Any workers have tested positive for or exhibited symptoms of COVID-19.
- Workers may closely interact with high-risk groups or those under quarantine.
- Contractors are not able to work due to state, tribal or local travel restrictions or medical quarantine.
- Workers can't maintain proper social distancing.

The EPA said that as of the beginning of April, on-site work has been reduced or stopped because of COVID-19 concerns at about 34 Superfund

"EPA remains committed to protecting human health and the environment as we continue to adjust to the evolving COVID-19 pandemic," EPA Administrator Andrew Wheeler said in a statement Friday.

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National Priority List sites, or 12% of all EPA sites with ongoing remedial actions.

“EPA remains committed to protecting human health and the environment as we continue to adjust to the evolving COVID-19 pandemic,” EPA Administrator Andrew Wheeler said in a statement Friday. “This guidance will allow us to keep workers and the residents in these communities safe while also being able to respond to any emergency that may present an imminent danger to the public health or welfare.”

The guidance may be used for cleanups taking place under the Superfund program, Resource Conservation and Recovery Act corrective actions, Toxic Substances Control Act cleanup provisions, the Oil Pollution Act, the Underground Storage Tank program and other programs, the EPA said.

When officials are deciding whether to reduce or suspend operations, the EPA said they should also consider the importance of the cleanup effort. For example, regulators should weigh the coronavirus factors with other considerations such as if failing to continue response actions “would likely pose an imminent and substantial endangerment to human health or the environment, and whether it is practical to continue such actions.”

The guidance follows other information released by the EPA last month notifying the public that it may temporarily suspend some compliance obligations for entities affected by the coronavirus crisis.

That policy generally divides compliance obligations into tiers and treats potential violations differently. Significant leeway will be given to businesses that show they can’t meet routine compliance monitoring and reporting requirements, while those at risk of allowing discharges or emissions that could damage human health and the environment will be scrutinized more closely. Once the coronavirus crisis has passed, the EPA said, the policy will be rescinded.

Law360.com, 13 April 2020

https://www.law360.com/environmental/articles/1262494/epa-issues-guidance-for-cleanups-during-coronavirus-crisis?nl_pk=bf1dfb5b-a5fd-4432-8963-aea6d64e00d0&utm_source=newsletter&utm_medium=email&utm_campaign=environmental

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EUROPE

Commission science committee deems hair-colouring ingredient safe for EU use

2020Y-04-14

The European Commission's Scientific Committee on Consumer Safety (SCCS) has adopted its final Opinion on the safety of the hair dye ingredient, indigofera tinctoria.

It considers the chemical to be safe when used in non-oxidative condition hair-colouring products at on-head concentrations of up to 25%.

However, the SCCS said in its 3 April Opinion that a weak skin sensitisation potential "cannot be excluded".

At the end of March, the Commission asked the committee to provide an opinion on the safety of the hair dye acid yellow 3 [mixture of the disodium salts of the mono- and disulfonic acids of 2-(2-quinoly)-1H-indene-1,3(2H)-dione]. It has until December to respond.

Chemical Watch, 14 April 2020

<https://chemicalwatch.com/106544/commission-science-committee-deems-hair-colouring-ingredient-safe-for-eu-use#overlay-strip>

Sweden to host online chemical regulation information seminar

YYYY-MM-DD

The Swedish Chemicals Agency (Kemi) is hosting a virtual seminar on chemical regulations on 23 April.

The free event, aimed at companies, authorities and other stakeholders with prior knowledge of chemicals legislation, will take place online due to the impacts of coronavirus Covid-19.

It will cover:

- temporary exemptions for biocidal product during the pandemic;
- REACH and CLP developments;
- the EU Green Deal;
- REACH safety data sheets (SDSs); and
- national enforcement.

It considers the chemical to be safe when used in non-oxidative condition hair-colouring products at on-head concentrations of up to 25%.

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In a recent interview with Chemical Watch, Echa head Bjorn Hansen confirmed that it is largely “business as usual” for the agency and that planned meetings will go ahead virtually.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108134/sweden-to-host-online-chemical-regulation-information-seminar#overlay-strip>

INTERNATIONAL

Saicm launches online information platform for chemical of concern

2020-04-16

The UN's Strategic Approach to International Chemicals Management (Saicm) has launched a website, dedicated to sharing information about chemicals of concern.

The Knowledge Management Platform was launched on 7 April and brings together resources, news and opinion articles, and information about events around the globe.

It is part of the Chemicals Without Concern project funded by the Global Environment Facility (GEF) to tackle emerging policy issues, specifically lead in paint and chemicals in products.

The website aims to explore “ways to create, manage and disseminate knowledge on chemicals of concern”.

It is currently a beta version and feedback is welcome.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108191/saicm-launches-online-information-platform-for-chemicals-of-concern>

The website aims to explore “ways to create, manage and disseminate knowledge on chemicals of concern”.

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REACH Update

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Lead chromates restriction proposal delayed

2020-04-16

Echa has delayed the submission of its REACH Annex XV restriction report on three lead chromate substances in articles.

This is because it may need to be revised according to the outcome of: ongoing discussions about the restriction of lead stabilisers in PVC, which was blocked by the European Parliament in February; and a pending court case on authorising the use of lead-based pigments – which the Swedish government initiated and the European Commission appealed against.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108277/echa-round-up#overlay-strip>

Commission adopts REACH chromate authorisation decisions

2020-04-15

The European Commission has adopted decisions granting REACH authorisation for certain uses of pentazinc chromate octahydroxide, dichromium tris(chromate) and potassium dichromate.

The first two are identified as SVHCs due to their carcinogenic properties and had a sunset date of 22 January 2019. Potassium dichromate is carcinogenic, mutagenic and reprotoxic (CMR) and had a sunset date of 21 September 2017.

This month, the EU executive permitted Aviall Services and Finalin the following use of pentazinc chromate octahydroxide:

in wash primers, fuel tank primers and aluminised primers for the purpose of corrosion protection in aeronautic applications where any of the following key functionalities or properties is necessary for the intended use: corrosion resistance, active corrosion inhibition, adhesion, chemical resistance, layer thickness, temperature resistance, compatibility with other substrate/other coatings, dynamic performance (only for fuel tank primer) and appearance (only for aluminised primer).

The Commission also granted both companies authorisation for formulation of mixtures exclusively for these uses.

Echa has delayed the submission of its REACH Annex XV restriction report on three lead chromate substances in articles.

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Additionally it permitted Wesco Aircraft EMEA authorisation for the following use of dichromium tris(chromate):

in chemical conversion coating applications by the aerospace and defence sector where any of the following key functionalities or properties is necessary for the intended use: corrosion resistance, active corrosion inhibition, adhesion promotion, chemical resistance, layer thickness and electrical properties.

The recommended review period for the authorised use, as well as those granted for pentazinc chromate octahydroxide, is 22 January 2026.

And the Commission has permitted Brenntag use of potassium dichromate:

for surface treatment of metals (such as aluminium, steel, zinc, magnesium, titanium, and alloys), composites and sealings of anodic films for the aerospace sector in the surface treatment processes in which any of the key functionalities listed in the Annex is required.

It also granted the company authorisation for the formulation of mixtures exclusively for this use.

The recommended review period is 21 September 2024.

The authorisation list – REACH Annex XIV – currently contains 54 chemicals. Last month, Echa started consulting on adding a further seven priority substances.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108025/commission-adopts-reach-chromate-authorisation-decisions>

REACH registration page for downstream users

2020-04-16

Echa has updated its web pages dedicated to helping downstream users navigate issues that may affect them regarding the registration of substances under REACH and the supply of substances critical to their business.

Chemical Watch, 16 April 2020

<https://chemicalwatch.com/108277/echa-round-up#overlay-strip>

Echa has updated its web pages dedicated to helping downstream users navigate issues that may affect them regarding the registration of substances under REACH and the supply of substances critical to their business.

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Janet's Corner

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A-Salt

2020-04-07



<https://www.pinterest.com.au/pin/758715868461962848/>

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Hazard Alert

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Glycerin

2020-04-07

Glycerin is a simple polyol compound that is colourless and odourless. It is a viscous sweet-tasting liquid; it is about 0.6 times sweeter than cane sugar. It is soluble in water and alcohol and has a boiling point of 290° C. It is generally obtained from plant or animal matter. Examples include soybean or palm or animal-derived tallow, respectively. It is non-toxic and it is not classified as a Dangerous Good. [1,2]

USES [2,3]

Glycerin is used in a myriad of ways, including in the food, medical and beauty product industries. It is used as a sweetener, solvent and humectant in foods and beverages. In the medical world, glycerin is used to treat open wounds and burns, as it has antiviral and bactericidal effects. For cosmetic use, glycerin is used to bring moisture to the surface of the skin and act as a smoothing agent. It is also used in oral and topical medications to help protect the skin and throat from irritants. Glycerin is also used in the ingredients for soap bubbles, and in the film industry for scenes with water in them to stop the water drying out too quickly.

ROUTES OF EXPOSURE [3]

- People can be exposed to glycerin by skin contact, inhaling it, or by consuming contaminated food, water or other drinks.
- The Food and Drug Administration (FDA) has placed glycerin on its Generally Recognised As Safe (GRAS) list of chemicals.

HEALTH EFFECTS

Glycerin poisoning affects a range of systems including the skin, nervous, respiratory and cardiovascular systems.

Acute Effects [1]

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

- If glycerin is ingested, it may lead to cramping, nausea, headaches, dizziness, drowsiness, vomiting and diarrhoea.
- If the compound is ingested in large amounts, it may cause dehydration, nausea, vomiting, kidney problems, a coma or death.

Glycerin is a simple polyol compound that is colourless and odourless.

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- Glycerin may cause irritation to the eye, including tearing, a burning sensation and redness.
- If absorbed through the skin, glycerin may cause irritation.

Chronic Effects [1]

Glycerin is toxic to multiple body systems. Long-term ingestion of the compound may cause headaches, dizziness, vision loss or blurriness, disturbance of smell, taste and sleep and trembling of the limbs. It has also been linked to physical weakness, loss of appetite, nausea, vomiting and diarrhoea. Chronic glycerin exposure has been linked to toxicity of the kidneys.

SAFETY

First Aid Measures [4]

- Ingestion: If ingested, rinse mouth and DO NOT induce vomiting. Immediately contact a doctor or a poison centre.
- Skin contact: In case of skin or hair contact, remove/take off all contaminated clothing and immediately wash exposed skin with mild soap and water. Follow this with a warm water rinse. Do not re-wear clothing until it has been decontaminated. Immediately call a doctor or poison centre.
- Eye contact: Flush eyes carefully with water for several minutes. Check for and remove contact lenses if easy to do so. Continue rinsing. Only obtain medical attention if symptoms, such as redness, pain or excessive blinking, persist.
- Inhalation: Take contaminated person to the nearest fresh air source and monitor their breathing. Allow them to rest and contact a medical professional.
- General: Never administer anything by mouth to an unconscious, exposed person.

Exposure Controls/Personal Protection [4]

- Engineering controls: Safety showers and emergency eyewash fountains should be accessible in the immediate area of the potential exposure. Ensure there is adequate ventilation. Whenever possible, material should be handled in a laboratory.
- Personal protection: Safety glasses, protective and dustproof clothing, gloves, an apron and an appropriate mask.

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REGULATION [5]

United States:

The Occupational Safety and Health Administration has set an 8-hour time weighted average (TWA) concentration for glycerin of $0.05\text{mg}/\text{m}^3$. For glycerin mist, they have set a TWA of $5\text{mg}/\text{m}^3$, concluding that these limits will protect users against potential long-term use on their kidneys.

Australia [1]

Safe Work Australia: Safe Work Australia has set an 8-hour time TWA for glycerin of $10\text{mg}/\text{m}^3$. However, it should be highlighted that the TWA values are likely to be higher than the biological standards exposure level for the compound; therefore, all reasonable steps must be taken to minimise the level of exposure to a level well below the workplace standard.

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Gossip

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Polio, measles, other diseases set to surge as COVID-19 forces suspension of vaccination campaigns

2020-04-09

“A devil’s choice.” That’s how Seth Berkley, head of GAVI, the Vaccine Alliance, describes the dilemma facing global health organizations in the past few weeks. They could either continue to support mass vaccination campaigns in poor countries and risk inadvertently helping to spread COVID-19—or recommend their suspension, inevitably triggering an upsurge of many other infectious diseases.

In the end, they chose the latter. As **Science reported last week**, the Global Polio Eradication Initiative on 24 March recommended suspending polio vaccination campaigns until the second half of the year. Two days later, the World Health Organization’s (WHO’s) Strategic Advisory Group of Experts on Immunization (SAGE) issued a broader call, recommending that all preventive mass vaccination campaigns for other diseases be postponed. “Any mass campaigns would go against the idea of social distancing,” says Alejandro Cravioto of the National Autonomous University of Mexico’s faculty of medicine, who chairs SAGE.

But experts say the fallout from the wrenching decision will be huge and may last long after the pandemic subsides. It comes on top of the damage COVID-19 will do to the fragile health systems in many countries.

Mass vaccination campaigns against a host of diseases are already grinding to a halt in many countries. For many children, these campaigns are the only chance to get vaccines. Some 13.5 million have already missed out on vaccinations for polio, measles, human papillomavirus, yellow fever, cholera, and meningitis since the suspensions began, Berkley says. “I tell you those numbers will be much larger than what we see today.”

In the case of polio, more children will be paralyzed in countries where polio is still circulating, and the virus will likely spread to countries that are now polio-free. The decision couldn’t come at a worse time. **The polio eradication effort is already reeling** from setbacks in Afghanistan and Pakistan, where the wild virus is surging, and in Africa, where outbreaks caused by the live polio vaccine itself are spiraling out of control. The program will reassess the decision every 2 weeks.

Twenty-three countries have already suspended their measles campaigns, and as a result, 78 million children will miss out on the vaccine, says Robb Linkins, a measles expert in the Global Immunization Division of the U.S. Centers for Disease Control and Prevention. Sixteen other countries are

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still deciding. Linkins foresees “tragic” consequences. In poor countries, the virus can kill 3% to 6% of those it infects, WHO says, with malnourished children especially at risk. Measles infected an estimated 10 million and killed 140,000 in 2018, the last year for which numbers are complete. And because measles is incredibly contagious, case numbers could quickly surge following the suspensions.

Unlike the polio initiative, SAGE stopped short of recommending that countries halt campaigns to quell ongoing measles outbreaks, but it said they should carefully weigh the risk of an immediate response against that of a delayed one. For now, campaigns are continuing in the Democratic Republic of the Congo, where the world’s biggest outbreak has so far killed an estimated 6500 children—far more than the ongoing Ebola outbreak in that country—and sickened more than 340,000.

WHO, GAVI, and other health organizations stress that routine immunization of individual children at clinics must continue as much as possible during the coronavirus pandemic. But health systems in many countries were already stretched thin, and protective gear is often lacking. Berkley fears severe disruptions of routine immunization if health workers are diverted to COVID-19 or become sick or die, or if parents are afraid to bring their children to a clinic. Vaccines may run out as well. Some countries are already experiencing shortages as flights are grounded and borders close, Berkley says.

Other essential health services will also be disrupted, says Augustin Augier, executive director of the Alliance for International Medical Action. Every year, ALIMA trains about 500,000 African mothers to diagnose acute, potentially fatal malnutrition in their children; those programs have been suspended. The knock-on consequences of the pandemic “will be much stronger and more lethal for the world’s most vulnerable populations,” Augier says.

Across all these programs, the goal is to regain lost ground quickly once the pandemic is over. In the meantime, WHO says, countries should continue surveillance for vaccine-preventable diseases to figure out where pathogens are circulating and which children are most at risk. But that, too, is a challenge amid the fear and disruption from COVID-19.

Berkley sees some hope in the experience in West Africa after the 2014–15 Ebola outbreak. “There was an unprecedented flow of finance and goodwill,” he says. “We did campaigns once Ebola was over and strengthened routine immunization. We not only recovered coverage levels, but exceeded them.” But that epidemic was largely confined to

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three countries with a combined population of fewer than 25 million people. This time, the entire world is affected.

sciencemag.org, 9 April 2020

<https://www.sciencemag.org>

Social scientists scramble to study pandemic, in real time

2020-04-08

If pandemic lockdowns have people feeling a bit like lab rats stuck in cages, in some ways that's exactly what they are.

As the coronavirus touches on virtually every part of life around the globe, social scientists are rushing to suck up real-time data on how people are responding to the unfolding pandemic. Economists are gathering data about supply chains. Political scientists are scrutinizing how government responses track with ideology. Psychologists are monitoring children in after-school programs. Behavioral scientists are surveying thousands of people to see how they respond to information in a crisis.

James Heckman, a Nobel Prize-winning economist at the University of Chicago, suggests researchers need to take to heart former Chicago Mayor Rahm Emanuel's adage: Never let a crisis go to waste. "Here, scientifically, I think we need to operate on that credo," Heckman says. "We're getting new information. It's very valuable information."

For some researchers, the pandemic has created an unexpected opportunity to run "natural experiments." Unlike physicists or biologists, social scientists are frequently constrained from using controlled experiments to test hypotheses. No university, for instance, would approve an experiment that involved firing one group of workers and seeing how they fare compared with their still-employed colleagues. But interventions such as natural disasters—or a pandemic—can help create such experiments, if a researcher is ready to take advantage.

For example, some social scientists are retooling existing studies, hoping to capitalize on the data they already collected to see how the virus is changing things. Dillon Browne, a child psychologist at the University of Waterloo, was studying the emotional well-being of kids in after-school programs in Toronto. Then, disaster struck. Twice. First, teachers started to go on strike, periodically shuttering the programs. Then, the pandemic closed them for good.

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The upheaval seemed like a disaster for the research, Browne says. But now his team has turned it into a study of how these dramatic changes impacted 235 kids. "It's been rolling with the punches and the punches keep flying," he says.

Charissa Cheah, a psychologist at the University of Maryland, Baltimore County, is recalibrating her research on how Chinese and Korean American children in the state cope with discrimination. With money from the National Science Foundation, which is working to quickly fund coronavirus-related research, she's surveying several hundred families she has studied over the past 5 years. She's also expanding to families elsewhere in the country. She's hoping to learn how parents and children are responding to anti-Asian discrimination that has surged with the virus, and what broader lessons it might hold about these dynamics. "I did see [the pandemic] creating, I wouldn't say opportunity, but a unique context in order to understand how some of these processes work," she says.

Economists are digging in as well. Matthew Kahn at Johns Hopkins University, Baltimore, has studied how industries cope with disasters. He and a collaborator are already gathering data to compare how companies are adjusting, depending on their supply chains and the different restrictions imposed by countries around the world.

He's also rewriting the closing chapter to a new book about the economics of climate adaptation. Now, it's going to talk about the coronavirus. "With any natural experiment, you're studying the cause and effect. In real time, these companies are reoptimizing in the face of these shocks," he says.

University of Chicago economist Lars Peter Hansen, another Nobel laureate, isn't embarking on any immediate research. But he has long been interested in how decision-makers and markets deal with uncertainty. In a situation wracked with unknowns, he wants to examine how everyone from investors to government policymakers to health care managers respond. "How to integrate uncertainty into these kinds of decisions seems, to me, a first-order challenge and it's definitely something I want to work on," he says.

But Hansen and several others caution that much of the emerging research might not fit the classic definition of a natural experiment, because the pandemic's impacts are so widespread and messy. The best natural experiments usually look at similar groups of people where one group experiences a very specific change, says David Figlio, an economist at Northwestern University who has worked extensively in education policy. In contrast, virtually no one has avoided the reach of the pandemic,

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and it touches so many parts of life. “There have been dozens of very smart people now saying, ‘Wow, this is going to be such an incredible opportunity to study things. And I’m not so sanguine about that,’” Figlio says.

Figlio notes that some researchers have suggested the mass shift to teaching classes online caused by the crisis could provide a natural experiment, testing how students perform with online education versus face-to-face classes. But he questions what the results will really show, when many teachers are being forced into online teaching with little preparation. “My hunch is people are going to stink it up this year,” he says.

Experts who study communication during disasters are also getting funding to launch studies. With help from a National Science Foundation grant, Ellen Peters at the University of Oregon, Eugene, has already surveyed 1300 people to see how their emotional state connects to what actions they take to protect themselves and who they considered reliable sources of information. Her team found that doctors and the Centers for Disease Control and Prevention ranked the highest among both conservatives and liberals, at 75% or higher.

In most disasters, such work would rely on people’s recollections after the worst has passed, Peters says. This time, “We’re actually trying to catch people as it’s happening.” The results could be of immediate use to policymakers, who have already asked Peters for advice. It could also shed light on long-term questions about how people interpret risk and decide what to do in a disaster. Peters plans five rounds of surveys, giving her a real-time window into how people’s emotions and actions are evolving in this globe-spanning experiment.

~sscienmag.org, 8 April 2020

<https://www.sciencemag.org>

The super-corals of the Red Sea

2020-04-09

Images of white, skeletal coral reefs are becoming an increasingly bleak, if familiar sight. Massive coral bleaching events are becoming more common around the world, as a result of the rapid pace of climate change. In the period from 2014 to 2017, about 75% of the planet’s tropical coral reefs suffered heat-induced bleaching during a global ocean heatwave.

A “bleached” coral is a stressed-out coral that, when triggered by environmental changes such as pollution and warming waters, has evicted

Yet, at the northern end of the Red Sea in the Gulf of Aqaba there is a ray – or, rather, reef – of hope.

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its beneficial, energy-producing algae. Without these symbiotic algae, the coral loses its colour and appears white. Recovery from bleaching can be possible, but it's not guaranteed. More frequent bleaching events mean less time for the corals to bounce back. Those that don't recover, die – and their ecosystem can collapse with them.

“As we see the frequency and intensity of mass bleaching events increasing, the situation is becoming more dire,” says Andréa Grottoli, a professor in the School of Earth Sciences at Ohio State University. Grottoli's research is focused primarily on the effects of climate change on coral reefs and what it is that makes some corals more resilient than others. “The models are projecting catastrophic losses in reefs by the end of this century.” Indeed, the majority of the world's coral reefs are predicted to die by the end of this century, if not sooner.

Yet, at the northern end of the Red Sea in the Gulf of Aqaba there is a ray – or, rather, reef – of hope. Coral reefs in the Gulf of Aqaba appear to be “content” with the increasing temperatures, as Anders Meibom, a geochemist running the Laboratory for Biological Geochemistry at the Ecole Polytechnique Fédérale de Lausanne (EPFL) and Institute of Earth Sciences in Switzerland, puts it.

“Despite sea temperatures rising faster [in this region] than the global average rate, no mass bleaching events have occurred in the northern Red Sea,” says Jessica Bellworthy, a dive guide and tropical coral doctoral student at Bar-Ilan University, who works in the coral research lab at the Interuniversity Institute for Marine Sciences on the Gulf of Aqaba in Eilat, Israel.

Maoz Fine, a Bar-Ilan University professor who leads this lab, first noticed that there was something distinctly different about the Red Sea reefs when he returned home to Israel in 2005 after researching reefs in Australia. Fine expected to see more degrading reefs of the kind he was used to there. But what he found in the Gulf of Aqaba were corals apparently unaffected by ocean acidification and the steadily warming waters.

In 2010, Fine designed a prototype of what would become the Red Sea Simulator (RSS), a large-scale, multiple aquarium system with the ability to simulate future ocean conditions and run experiments that might shed light on what it is that makes the corals here so resilient.

With this system at the Gulf of Aqaba, the team is able to study corals and water from the Gulf, and adjust the acidity and temperature in the tanks according to their experiments. Multiple aquariums mean that more

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researchers can run experiments simultaneously, in the hope to better understand the physiology and genetics of the reef ecosystems.

“Coral reefs are biodiversity reservoirs and significant sources of food, income, and pharmaceuticals. We have a small window of opportunity remaining to apply science to rescue the world’s degrading reefs,” says Karine Kleinhaus, a professor in the School of Marine and Atmospheric Sciences at Stony Brook University. “But unless we uncover what exactly happens biologically in the corals of the Gulf of Aqaba that allows them to withstand warming temperatures, we don’t know how or if this knowledge can be applied elsewhere.”

Of particular interest, Kleinhaus says, are any important ecological factors in the reefs that “amplify any innate coral resilience or potential to recover from bleaching”. These could be particular phases of reduced pollution in the water, or periods of relief from overfishing.

Today, the RSS is 88 aquariums strong. All can be controlled remotely, allowing researchers to monitor them and make adjustments from wherever they are in the world – particularly important given that obtaining a visa to work in Israel is not always easy for some researchers. So far, the team has tested about 20 different species of Red Sea corals in the Gulf of Aqaba and found them much more tolerant of increased temperature.

Typically, a 1-2C increase beyond the summer maximum temperature would cause corals to dispel their algae and, often, die. Meibom and Fine’s unpublished research suggests that, while resilience varied between the corals they tested, overall, the corals easily withstood 4-5C above the current summer maximum. Some have even survived as much as 7C above the summer maximum.

Not only are these corals proving resilient, but actually appear to do better in warmer waters. In some cases, their symbiotic algae doubled the amount of oxygen they produced and showed a 51% increase in primary productivity.

The secret to the Red Sea corals’ strength is thought to be a product of their past.

“This population of corals [in the northern part of the Gulf of Aqaba] migrated into the Red Sea system from the south where the temperature of the water is – and always was – high,” Meibom says. As you move north, the water temperature drops. Over thousands of years, some of these

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corals migrated north to where they now live at lower temperatures – today the Gulf of Aqaba is 27-28C.

But, it seems these corals retained their capacity to live at higher temperatures. “They still remember *in their biology* how to live at 33C,” says Meibom. “So if you increase the temperature to 31C, for example, they’re still happy.”

Other corals around the world don’t typically possess the same biological ability to persist. Given the global climate warming trajectory we are on – headed for a 2-3C increase or more by the end of the century, only corals that are now living well below their maximum temperature will be able to tolerate that change.

At this rate, the Red Sea reefs could be one of the last standing by the year 2100. “We know of corals in other regions that live in very hot water and survive,” Fine says, “but none that have such a large gap between the summer maxima and their bleaching threshold.”

And as one of the last coral reefs to survive, the Red Sea reefs could potentially “form a refuge where it becomes one of the few remaining reefs with full ecosystem function”, says Grottoli. “It could serve as a model for restoration once climate change stress is mitigated and we start being able to actually reintroduce coral... it could serve as a model for what a normal reef might look like.”

But in order for it to serve as a refuge and possible model in the future, it will need to survive more than the rising temperatures; nutrients and heavy metals from human activity such as unchecked coastal development, agricultural and wastewater runoffs, boats and fish farming could be the super-coral’s kryptonite. When Fine and the team introduce nutrients such as nitrate, ammonium and phosphate into the experiments, the corals’ physiology is compromised and they’re no longer as resilient. “It’s not enough to be resilient to temperature,” Fine says. “If we are to secure the Gulf of Aqaba and the northern Red Sea as a coral reef refuge, we have to remove the local stress.”

Along with Fine, Meibom, and several other scientists and diplomats, Kleinhaus is calling on Unesco to declare the Red Sea reef as a Marine World Heritage Site, to help ensure that the reef persists and will be protected from local threats that could otherwise compromise the coral’s resilience.

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The Red Sea project faces challenges that stretch beyond the borders of science and into diplomacy. Fine, Meibom and their team are planning an ambitious expedition to sail on a research boat called Fleur de Passion from the north to the south of the Red Sea. The expedition may inevitably be delayed by the coronavirus pandemic for now.

But it's a mission that, if it comes off, could offer insight into the reasons behind the corals' resilience and a glimpse into their future. "When you move south in the Red Sea, you're essentially sailing into the future in terms of coral resilience to climate change," Meibom says, "everything gets warmer and warmer."

Meibom believes that intelligent sampling and genetic analysis of key coral species in the Red Sea, alongside understanding the environmental conditions they live under, could lead to a new way of thinking about how reefs work – including how they are connected. One key question is how corals act as "source" and "sink" regions in terms of creating and receiving coral offspring.

Identifying source regions can help guide reef management or remediation efforts in the region. And, as Grottoli says about her own coral reef and climate research, it's important to try to understand the underlying traits that drive resilience in corals to make better-informed decisions on management, conservation and restoration.

The expedition would require funding, in addition to research permits from the majority of countries that border the Red Sea: Djibouti, Egypt, Eritrea, Israel, Jordan, Saudi Arabia, Sudan and Yemen. The region doesn't exactly have a strong record of collaboration, and some of the Red Sea countries do not have diplomatic relations with one another. What they do have is a common interest in corals, whether or not they all realise it yet; if the reef is harmed, so too are the ecosystems and economies that depend on it.

"Looking into the future, this is really the livelihood of people of the Red Sea. I consider myself as one," says Fine, a native of Israel. "Here there's an amazing opportunity to prepare reefs for climate change, to allow them to persist and flourish. This is something that doesn't exist in other regions."

Sara Cannon, a doctoral candidate at the University of British Columbia's Department of Geography and the Institute for Oceans and Fisheries, believes the Red Sea corals could indeed have the potential to help other corals. "By understanding what makes these corals more resilient, scientists could possibly help corals in other places adapt, using a process called

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assisted evolution," she says. Cannon's research is focused on attempting to understand ways that local and global human impacts interact to influence coral reef health and resilience in the central Pacific Islands. The Red Sea could provide information to help scientists to save reefs in other parts of the world that have not had the same opportunity to adapt, she says.

"And, the sad truth is that even if we could magically stop all greenhouse gas emissions immediately, global temperatures and carbon dioxide will remain high for centuries," says Cannon. "To save reefs, we need to stop climate change, but we also need to consider how we can help corals adapt given that some effects of climate change have already become unavoidable. Corals in the Red Sea could be invaluable in that research."

Bringing the planned expedition to fruition will require some skilled scientific diplomacy. So, together with the Swiss foreign ministry, Meibom and Fine helped create The [Transnational Red Sea Centre \(TRSC\)](#) in 2019. There has already been global interest in the organisation. "At the diplomacy level, we have ambassadors worldwide visiting and expressing support," Fine says.

Cannon feels the TRSC is on the right track. "There is a lot we don't understand about how climate change interacts with local stressors to impact coral reefs, and we're still learning how best to measure different responses to stress on coral reefs," she says. "A group like the researchers who come together at the TRSC – especially one that prioritises diverse local voices – is integral to solving complex problems like threats to coral reefs, and to finding novel ways to save them."

As soon as the TRSC can secure sufficient funding and permits, Meibom and Fine plan to set sail. Originally slated for this summer, the expedition is likely to be delayed by the ongoing coronavirus pandemic. When the yacht does set sail, it will begin the first leg of the expedition in Jordanian waters at the northern tip of the Gulf of Aqaba.

Coronavirus aside, it's too soon to predict whether it will be smooth sailing or rough waters ahead. Fine and Meibom are optimistic that people across the region can put their politics aside and band together to protect the Red Sea reefs. "Reefs recognise no political borders," Fine says. "What happens in one reef will affect the rest of the reef on the other side of the border."

Politically and scientifically, there is a lot riding on this expedition. "This is probably our last chance [globally] at saving a major reef ecosystem

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that could be well-functioning 50, 60, 100 years from now," Meibom says. "It's a treasure. And it has enormous impacts on the region. So everybody has a common interest in preserving it – not only in the Red Sea, but for humanity."

bbc.com, 9 April 2020

<https://www.bbc.com>

Pollution made COVID-19 worse. Now, lockdowns are clearing the air

2020-04-08

As the novel coronavirus tears around the world, it's exploiting our biggest weaknesses, from creaking health care systems to extreme social inequality. Its relationship with one pervasive and neglected problem, however, is more tangled: Air pollution has intensified the pandemic, but the pandemic has—temporarily—cleaned the skies.

When new evidence emerged this week that dirty air makes COVID-19 more lethal, it surprised no one who has followed the science of air pollution—but the scale of the effect was striking. The study, which must still undergo peer review for publication, found that the tiny pollutant particles known as PM2.5, breathed over many years, sharply raise the chances of dying from the virus.

Researchers from Harvard University's T.H. Chan School of Public Health analyzed data on PM2.5 levels and COVID-19 deaths from about 3,000 U.S. counties covering 98 percent of the U.S. population. Counties that averaged just one microgram per cubic meter more PM2.5 in the air had a COVID-19 death rate that was 15 percent higher.

"If you're getting COVID, and you have been breathing polluted air, it's really putting gasoline on a fire," said Francesca Dominici, a Harvard biostatistics professor and the study's senior author.

That's because the fine particles penetrate deep into the body, promoting hypertension, heart disease, breathing trouble, and diabetes, all of which increase complications in coronavirus patients. The particles also weaken the immune system and fuel inflammation in the lungs and respiratory tract, adding to the risk both of getting COVID-19 and of having severe symptoms.

Dominici and her colleagues illustrated the impact with a specific example: Manhattan, the current epicenter of the pandemic, where

Counties that averaged just one microgram per cubic meter more PM2.5 in the air had a COVID-19 death rate that was 15 percent higher.

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PM2.5 averages range as high as 11 micrograms per cubic meter, and where 1,904 deaths from COVID-19 had been reported as of April 4. Had particle levels averaged just one unit lower over the past two decades, the researchers calculated, 248 fewer people would have died over the past several weeks. And of course the toll has mounted since April 4.

But while pollution inhaled in the past is still causing harm today, the temporary experience of cleaner air brought about by widespread shutdowns may offer lessons for the kind of world we want to build after the pandemic.

People so accustomed to pollution they hardly think about it may realize, “Actually, I really do quite enjoy clean air: Do you think we could get it, or keep it?” says Simon Birkett, founder and director of Clean Air in London, an advocacy organization. “There’s a chance to really get people to stop, take a deep breath,” and reflect on questions like “How was your asthma during this period?”

Although a near-halt in normal life and economic activity is no one’s idea of a good way to reduce pollution, the brief respite might, in Birkett’s view, turn this dark time into “a catalyst, or a tipping point, which could get us to say ‘Clean air—there’s something special about it.’”

Cleaner pandemic skies

From China’s Hubei province to industrial northern Italy and beyond, pollution levels have plummeted as lockdowns aimed at slowing the viral spread have shuttered businesses and trapped billions of people at home. In India, where air pollution is among the world’s worst, “people are reporting seeing the Himalayas for the first time from where they live,” Lauri Myllyvirta, lead analyst at the Helsinki-based Centre for Research on Energy and Clean Air, said in an email.

India’s hastily imposed shutdowns have been devastating, leaving hundreds of thousands of migrant workers without homes or jobs. But in Delhi, where air is normally choking, levels of both PM2.5 and the harmful gas nitrogen dioxide fell more than 70 percent.

The declines are sure to be only temporary. To get healthier air or the longer term, Myllyvirta said, means shifting to clean energy and transportation, “not ordering people to stay at home at drastic economic cost.” But the cleaner pandemic skies do show how fast we can bring down pollution when we reduce our burning of fossil fuels.

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The cleaner air is also a reminder of how deadly air pollution is. The World Health Organization says dirty air, both indoors and out, cuts short seven million lives annually worldwide.

In the United States, decades of regulation have led to air quality that is far better than in most of the world. In New York City, for example, PM2.5 levels actually fell 30 percent from 2009 to 2017, which has presumably saved many lives during the current pandemic. Nevertheless, air pollution still kills more than 100,000 Americans every year.

The realization that COVID-19 may match or even exceed that toll has rightly terrified Americans. But the lethal effects of air pollution are barely discussed—and activists and scientists are hoping that might change.

Pollution and COVID-19

Even before the new Harvard study, scientists were convinced that air pollution was likely worsening COVID-19's impact, in addition to the wide-ranging health damage it causes on its own. A 2003 study of the outbreak of SARS, the closest relative of the new coronavirus, found that death rates in China's most polluted areas were twice as high as in the least polluted ones.

"You could bet a fiver that London and other more polluted places will have higher mortality rates [from the virus], because there'll be more people with underlying issues," Birkett said. Scientists also believe viruses may bond with pollution particles, enabling them to remain in the air longer and helping them make their way into the body.

The flip side is that even temporarily cleaner air can help "flatten the curve" of the pandemic, easing the burden on health care systems by reducing the number of people who experience severe COVID-19 symptoms, said Christopher Carlsten, head of respiratory medicine at the University of British Columbia's School of Population and Public Health, in Vancouver.

Cleaner pandemic skies should also reduce other pressures on hospitals struggling with COVID-19 cases, Carlsten said. In addition to the cumulative effects of breathing dirty air for years, a large body of evidence shows that short-term changes in air quality have an immediate impact on heart attacks, strokes, and emergency room visits. All increase when pollution spikes.

Authorities in British Columbia had that hope in mind when they issued restrictions on the fires farmers typically light at the start of

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spring to clear old growth from fields. One region in British Columbia even banned campfires. Wood smoke is thick with PM2.5 particles.

In China, the drops in pollution resulting from coronavirus shutdowns likely saved between 53,000 and 77,000 lives—many times more than the direct toll of the virus—according to calculations done by Marshall Burke, an Earth system scientist at Stanford University. That might sound surprising, but it shouldn't be, he said, given that air pollution causes more than 1.2 million annual deaths in China. Indeed, a 2016 study found that China's aggressive measures to clean the air in and around Beijing for the 2008 Olympics had led to a temporary 8 percent drop in the overall death rate.

Burke emphasized that in estimating the benefit of China's less polluted air, he was in no way minimizing the cost or the horror of the pandemic. But "these other things we do, that we can change, are also important," he said. "Lives we lose absent a pandemic are also really important, and are lives we shouldn't lose."

After the pandemic—what?

There's no doubt the pandemic-driven clearing of the air will be short-lived, with emissions sure to return to, if not surpass, their usual levels whenever factories start up again and people get back in their cars.

That's already happening in China, where pollution has returned to its pre-coronavirus range, Myllyvirta said, even though some industries are not yet fully operational—a worrying hint that air quality could end up worse than before, he added.

That's a danger elsewhere too. When the pandemic finally abates, polluting industries may well seek to make up for lost time with even higher production, said François Gemenne, a political scientist and environmental researcher at the University of Liège, Belgium. If the virus makes people fearful of public transportation, driving could increase also.

What's more, "a lot of governments will be inclined to restart their fossil fuel industry, because that is the industry that is immediately available," Gemenne said. With recession looming and credit markets taking a hit, analysts say investment in wind and solar power is likely to sag.

Economic troubles often prompt governments to loosen health-protective regulations. In the United States, the Environmental Protection Agency has cited the pandemic as justification for a decision to all but suspend enforcement of pollution rules. The Trump administration is also rolling

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back ambitious Obama-era auto mileage standards, and unraveling other regulations too.

In the middle of a health emergency, it's exactly the wrong move, said Susan Anenberg, associate professor of environmental health at the George Washington University. On the contrary, she argued, "it's the time to be considering whether the status quo that we had in place prior to this disaster is the one we want going forward. We don't need to tolerate this level of air pollution."

[nationalgeographic.com](https://www.nationalgeographic.com), 8 April 2020

<https://www.nationalgeographic.com>

EU food safety passed COVID-19 test, MEP says

2020-04-09

The European food supply chain and food safety system are proving to be extremely resilient, according to Europe's People Party (EPP) coordinator at European Parliament's Agriculture Committee, Herbert Dorfmann, as people still manage to find available and safe food on supermarket shelves even in time of the COVID-19 pandemic.

Speaking at a webinar organised by the platform SME Connect on how to ensure the highest food safety standards during the crisis, Dorfmann added that another important message is that the public opinion excluded any implication of the food industry in the spread of the virus.

"People trust food in a moment where food is worth much more than lots of other goods," he said.

According to him, the whole food supply chain is also reacting well to the challenges the pandemic is bringing in terms of making food available to everyone.

"We've seen some empty supermarkets but this is not due to the food supply chain but due to people buying more than they actually need," he explained.

As the food sector could be put under pressure in the weeks to come, Dorfmann envisaged a test also for the working mechanism included in the Common Agricultural Policy (CAP) to avoid disruption in the markets.

He mentioned the problems in the minced meat sector caused by the closing of fast-food chains like Burger King or McDonald's, with a consequent decrease in consumption weighing upon meat prices too.

"We've seen some empty supermarkets but this is not due to the food supply chain but due to people buying more than they actually need," he explained.

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“At a certain point, we will need to intervene and we will see if the mechanism we have today work,” he added, saying that this test will be useful also to improve the EU crisis management instruments in the post-2020 CAP reform talks.

During the webinar, Giorgio Ferraris, CEO of Fine Foods & Pharmaceuticals and adviser of the SME Connect, gave the example of how his company, based in Bergamo, one of the worst-hit cities from coronavirus in Italy, is facing this extreme situation in terms of protecting workers and the manufacturing.

Although located in one of the acute hotspots of the pandemic, his company managed to be a safe place after having adopted significant changes to the way they work, including working shifts, staying at home when showing first symptoms of sickness, providing dressing rooms and by sanitising possible contagious surfaces.

Already in early February, a safety team discussed protective measures for workers which have later turned out to be the same as the measures adopted by the government in its safety guidelines.

“I think companies have a role in teaching people and making them sensitive to the risk,” said Ferraris.

He added that it is particularly SMEs like his, which are more sensitive to the risk of microbiology and contamination, that have a different understanding of what is happening than the ordinary population. This gives them a role to help their people understand the extent of the crisis.

eurativ.com, 9 April 2020

<https://www.eurativ.com>

When will lockdown end? Nations looks for coronavirus exit strategies

2020-04-07

Bans, curfews and wide-reaching restrictions. For many people worldwide, severe limitations on daily life because of the coronavirus have become the new normal. But as we adjust to these measures, what prospect is there of returning to the old normal? What is the world's exit strategy?

If you are hoping for a return to your old life, there is good news and bad news: it will happen, but not necessarily soon. “It is absolutely the case that government advisers and researchers are considering the question of

If you are hoping for a return to your old life, there is good news and bad news: it will happen, but not necessarily soon.

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an exit strategy,” says epidemiologist Mark Woolhouse at the University of Edinburgh, UK. But what different nations’ exit strategies will look like, how long we will have to wait for them, and whether they will work, are all still up in the air. In addition to this, a lack of coordination at the international level could spell trouble when the time comes.

The lockdowns that many nations are enduring are a short-term strategy to reduce the average number of subsequent infections each pan case causes, in order to stop the rate of infections increasing exponentially. This is known as “flattening the curve”. The approach is intended to prevent hospitals being overwhelmed, which should lessen the death count. It also buys time to develop new treatments and better understand the infection.

Lockdown isn’t a long-term strategy, however. “We want to get out of lockdown because of all the damage it is doing to society as a whole, economically and psychologically,” says Woolhouse. But there is a risk to lifting restrictions that have successfully flattened the curve: the curve unflattens and the rate of infection returns to exponential growth. “We want to get out, but we don’t want the epidemic to take off again,” says Woolhouse.

In other words, the two things we want to achieve – a flat curve and an end to lockdown – are incompatible. Devising an exit strategy, then, becomes a question of determining the best time to lift restrictions, and the action to take to keep infection rates under control.

One thing is clear: we can’t bank on a vaccine getting us out of this. It will take many months to develop an effective one – if we manage it at all. “I do not think waiting for a vaccine should be dignified with the word ‘strategy’. It’s not a strategy, it’s a hope,” says Woolhouse.

So how do you get out of lockdown without unleashing a dangerous “second wave” of infections among people who weren’t exposed to the virus the first time round? A second wave like this is “highly likely”, says Susy Hota, medical director of the infection prevention and control programme at the University Health Network in Toronto, Canada.

“Waiting for a vaccine shouldn’t be dignified with the word ‘strategy’. It is just a hope”

Any second wave will probably be less severe than the first, says Woolhouse. “With any newly emerging virus, it’s the first wave that is the worst. After that, it will settle down and become much more manageable.” For example, since the 2015 to 2016 Zika epidemic, subsequent outbreaks

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have tended to fizzle out due to the detection and control measures now in place, plus a degree of immunity.

Exit strategies therefore have to include a plan to manage a second wave. Broadly, there are three ways to do this: we can call them hold, build and shield.

The hold strategy plays the long game: lockdown until the rate of new infections falls close to zero, then lift the lockdown and pivot to an aggressive containment strategy. That means diagnosing second-wave cases as quickly as possible, isolating them, tracing their contacts and isolating them too, if necessary, to cut all new lines of transmission.

That requires building the capacity to do far better containment and contact tracing than most countries managed the first time round. Waiting for the infection rate to be near zero also risks having to impose lockdown for a long time.

Increasing capacity

The second strategy, build, buys time for health services to recover from the first wave and build capacity to deal with the second. In richer nations, health services' limiting factors are intensive care beds and staff. So this strategy involves locking down for long enough to recruit enough of both, then releasing restrictions gradually and dealing with the second wave, hopefully with a much lower mortality rate. But how much intensive care capacity is enough to achieve that? It is a difficult question, and a wrong answer could cost many lives.

Option three, shield, is to end a lockdown abruptly while extensively protecting those who are likely to be most vulnerable to the virus. This means finding ways to ensure the safety of older people and those with health conditions that make them more likely to get seriously ill and die. Pulling this off requires widespread community screening to find out who is infectious – especially people with no symptoms – and making sure they don't come into contact with vulnerable people.

Another element of this is developing antibody tests to identify medical staff and care workers who have recovered from the virus and may therefore be at a lower risk of infecting others.

The overall effect would be to reduce critical cases and deaths, and hence take pressure off hospitals while allowing herd immunity to build up in the less-vulnerable population. Covid-19 can kill younger people without other health conditions, albeit not often, but if shielding can reduce the

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number of cases among more vulnerable people, healthcare services should be better placed to treat these.

Choosing between these three strategies depends to a large extent on a few unknowns, particularly how quickly a population crosses the threshold into herd immunity – the point at which enough people have acquired antibodies to the virus to stop it from readily circulating in the population.

We don't yet know if recovering from covid-19 makes you immune to the virus in the long term. But even if immunity is only temporary, once enough people have encountered the virus, herd immunity will still slow or stop its spread for a while. "Herd immunity will kick in if the infection spreads widely enough," says Woolhouse. "But we need a better understanding of herd immunity to this virus to decide between the three options." If herd immunity builds quickly, then option three is perhaps the least worst, for example.

All three strategies may also have to be abandoned or temporarily suspended if second waves get out of hand, which could mean a repeat cycle of lockdown, relaxation, lockdown. "It's certainly possible that once we have released the lockdown we may need to reintroduce it," says Woolhouse.

The UK's deputy chief medical officer, Jenny Harries, recently said she expected the UK to be able to begin lifting restrictions sooner rather than later, but warned that they couldn't be lifted all at once, and may have to be reimposed.

"If we are successful, we will have squashed the top of that curve, which is brilliant, but we must not then suddenly revert to our normal way of living – that would be quite dangerous," she said. "If we stop then, all of our efforts will be wasted and we could potentially see a second peak. We need to keep that lid on and then gradually we will be able to hopefully adjust some of the social distancing measures and gradually get us all back to normal."

The chances of success for any of the strategies are unknown. They can be assessed using models, but their calculations are only as good as the numbers and assumptions they are based on, and even then can produce highly uncertain results. One recent modelling study of how the UK epidemic might pan out over the next 18 months concluded that "the inherent randomness of societal processes can lead to a wide range of possible outcomes".

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“Models are based on major assumptions and often these assumptions are wrong,” says virologist Jonathan Ball at the University of Nottingham, UK. “Whilst such models can give an insight into what might happen, they can’t tell us what will happen, and the sooner we realise this the better.” There is no substitute for on-the-ground research, he says.

Learning from China

For that, many are turning to China, the initial centre of the epidemic. “China was the first country to enforce lockdown,” says epidemiologist Caroline Walters at Imperial College London. “So because they’re a little bit ahead, I think there will be a lot of eyes on how they are handling the situation.”

China has essentially followed the hold strategy, imposing strict social distancing in Wuhan in Hubei province on 23 January, where the outbreak started. This was closely followed by similar measures elsewhere, which appears to have contained the outbreak. On 23 March, the Chinese government announced that, for the first time since the epidemic began, there had been five consecutive days with no new cases in the country caused by local transmission. Restrictions have now been relaxed, including across most of Hubei, and are due to be lifted in the city of Wuhan on 8 April.

“Life is not back to normal, but they started to slowly let people move around a little bit more,” says Walters. “They are not in full lockdown like they were.”

Extensive testing and contact tracing is being combined with some continuing social-distancing practices. China has also closed its borders to everyone except citizens to reduce the number of new cases coming in from abroad.

“Early signs suggest that China has to some degree successfully exited stringent social distancing”

As a result, economic activity seems to be rebounding, according to a recent study from Imperial College London’s COVID-19 Response Team, of which Walters is a member. The team obtained a data set of the level of movement within major cities in every province of mainland China between 1 January and 17 March, captured by the Chinese search engine Baidu’s location-based services on phones.

“We used movement data as a proxy for economic activity,” says Walters, “and we had data on the case numbers of coronavirus.” Movement is linked

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to economic activity as it indicates people are shopping and going to work.

They found that, in the early part of the data set, levels of movement were closely correlated with the number of new cases, indicating that people were spreading the virus as they went about their daily lives. But once the containment measures had been imposed and then relaxed, that correlation disappeared.

“Transmission was staying low, despite people being able to move,” says Walters. “We’re seeing some people being able to return to normal economic activity without the virus returning to the same level of transmission.”

She warns that these results don’t prove anything. “All we’re looking at is a correlation, not causation, we can’t say directly ‘this caused this.’” The team also warns that the results don’t rule out further outbreaks, or predict when activity will fully return to normal. But the study concludes that the results “do suggest that China has successfully exited their stringent social distancing policy to some degree”.

Lack of coordination

Last month, both sectors of China’s economy, services and manufacturing, reported a return to growth after a major slump in February. China’s National Bureau of Statistics says that more than half of enterprises had resumed work, although it cautions that China’s economy hasn’t yet returned to normal.

Reports are also emerging that some recently reopened businesses such as cinemas and bars are being abruptly shut again. Authorities haven’t explained these closures, according to [a report in The Washington Post](#). But just before they happened, National Health Commission spokesperson Mi Feng said “the possibility of a new round of infections remains relatively high”. Epidemiologists say that if a second wave hits China, it will be evident by the end of this month.

So can China serve as a model for the rest of the world? To some extent yes, says Walters, but exit strategies will have to be adapted to local conditions. “Not all countries are going to have the capacity to do the testing or the contact tracing,” she says. Even within China, exit strategies differ from region to region, according to local circumstances.

The European Union has said it is [working on a coordinated exit strategy](#), but as yet there are no details. Some countries that are still in the early

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stages of outbreaks, such as Canada, have yet to even start thinking about how to exit, says Hota.

Up to now, exit strategies are being handled at a national or transnational rather than international level despite the outbreak being a pandemic, says Woolhouse. The World Health Organization told *New Scientist* that there is no global exit strategy yet, saying that the organisation is currently focusing on responding to the virus instead.

Whatever exit strategies are eventually put in place, it is likely we will eventually get back to something resembling our old lives. "We have to find a way of living with this virus and still functioning more or less as normal," says Woolhouse. "I think we are going to be living with this virus for possibly forever but certainly the foreseeable future. So the long-term strategy is, how do we live with covid-19?"

In a year or so, vaccines may become a part of the answer, and improved treatments and some level of herd immunity will play a role too.

"I think that we will get back to our old lives," says Walters. "Pandemics have happened before. People may end up feeling a bit differently about the world they live in, but what we're experiencing right now is not forever. It's a measure brought in to achieve a certain goal, which is the flattening of the curve to protect our health system. We don't know exactly when it will end. But it will end."

[newscientist.com](https://www.newscientist.com), 7 April 2020

<https://www.newscientist.com>

Coronavirus secrets of the Faroes

2020-04-07

The Faroe Islands has managed to test nearly 10% of its population for coronavirus and no one has died from the disease so far. Its virus strategy was undoubtedly helped by its remote location but the main reason for the rapid response is a surprising one: the humble salmon.

Despite lying 300km north of Scotland in the middle of the Atlantic, the Faroe Islands has not managed to avoid the reach of the coronavirus outbreak. But its method of mass-testing, tracing and quarantining suspected cases has paid off in a big way.

The Faroe Islands is one of only five European countries – with Georgia, Latvia, Liechtenstein, and Malta – that has not recorded any coronavirus

Its virus strategy was undoubtedly helped by its remote location but the main reason for the rapid response is a surprising one: the humble salmon.

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deaths as of 6 April. It also leads the way in the percentage of the population tested.

Nearly 10% of the roughly 50,000 people that inhabit the islands has been tested for coronavirus, which has allowed the authorities to identify a total of 183 cases and track anyone who came into contact with infected patients.

Fifty-eight percent of those total cases have since recovered from the virus and only one person needed to be hospitalised. The government is now considering a “careful and partial” lifting of its lockdown after the Easter break.

Its quick and effective response was made possible by testing facilities in situ on the islands, which are able to process 600 tests per day in under eight hours. The reason behind such high capacity in such a small country is a viral epidemic among its fish that struck 20 years ago.

In the early 2000s, the lucrative Faroese fish industry – which accounts for 90% of the archipelago’s total exports – was hit hard by a viral disease which causes anaemia in salmon.

Infectious salmon anaemia virus (ISAV) is related to the influenza group of viruses and is often fatal to the Atlantic salmon, which is prized by Faroese fishermen. There is no cure once fish stocks are infected.

That is why the archipelago’s government decided to invest in advanced testing equipment and set up a dedicated laboratory to ensure fish health and keep the economy running. Now it was just a matter of adapting it for human tests.

Former Faroese finance minister Kristina Háfoss explained to EURACTIV how a decision was made early on by the health authorities to build capacity and how the laboratory was up and running by late February.

“If the tests had to be sent to Denmark for analysis, it would take days before the results were ready. That would not make it possible to follow the current strategy,” Háfoss said.

It is not the first time that fish-testing has proved useful during health scares. In 2009, the swine flu or H1N1 virus made its way to the Faroe Islands and that experience also helped laboratories prepare for the task currently at hand.

Háfoss pointed out that an added benefit of using equipment intended for treating fish diseases “gives more flexibility in terms of suppliers than most

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hospitals and laboratories, which should make it easier to restock should they run out of test kits and other supplies”.

Other countries have hit obstacles in procuring medical devices and equipment. Last week, the UK discovered that the millions of antibody testing kits it had ordered are not fit for use and the Netherlands realised a consignment of ventilators were not up to code.

Faith in the Faroese healthcare system will increase, according to lawmaker Háfoss, who said the “system is well equipped, the staff is well educated, and has shown to be even stronger than people normally believe”.

The Faroe Islands is part of the Kingdom of Denmark, along with Greenland, but is a self-governing country. According to Háfoss, her country has more doctors, beds and ventilators per person than its Scandinavian partner.

Beyond treatment

Faroese efforts are not focused solely on treating the virus though, as the archipelago’s best and brightest are set to join the race to find a viable vaccine. Kristina Háfoss explained how extensive testing means health professionals have learned a lot about the pathogen already.

Scientists at the iNOVA research centre – based in the country’s capital, Tórshavn – are ready to start work on sequencing the coronavirus genome as soon as funding is secured.

CEO of the centre, Janus Vang, said that “Faroese researchers can create a research strategy that’s entirely based on local circumstances, and we now have the facilities to analyse our own data.”

He added that the “substantial amount of research data in the shape of record-high numbers of corona tests to accurately track the spread of the infection” can help map the genetic make-up of coronavirus, which will be a crucial step in finding a vaccine.

A Danish science foundation has told the Faroese authorities that they are eligible to apply for 50 million kroner (€6.6m) in research funding. The islands – although not an EU member – might also be able to tap into money from Brussels.

“We are part of the Horizon 2020 programme. Researchers from the Faroe Islands cooperate with researchers in other European countries on several projects, and hopefully there will also be funding and cooperation on Covid-19 research,” Háfoss told EURACTIV.

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The European Commission announced in March hundreds of millions of euros in funding for vaccine research programmes, including €80 million for a German company that US President Donald Trump tried to tie to an exclusive vaccine deal.

The Faroe Islands are not the only remote north Atlantic country making big strides in the virus fight: Iceland has also embarked on a vast testing spree – 25,000 people tested out of a population of 360,000 – and is reaping the benefits.

Iceland, unlike many other countries, has tested people regardless of whether they show symptoms and that non-discrimination has yielded more findings about the behaviour of the virus.

The head of the private company in charge of testing, Dr Kári Stefánsson, said the results collected so far reveal that 50% of patients testing positive for coronavirus said that they did not have any of the symptoms associated with it.

“What it means in my mind, is that because we are screening the general population, we are catching people early in the infection, before they start showing symptoms,” Stefánsson said, adding that the results will also provide insight into how the virus mutates.

The health authorities estimate that 50,000 Icelanders – 13% of the population – could be tested before the pandemic has run its course.

Stefánsson also refuted suggestions that Iceland was able to tackle the virus so effectively purely because of its relatively small population. “It’s nothing to do with the size of the population, this has to do with how well prepared it was,” he insisted.

The medical professional also said that the “amazing collection of talent” in many developed countries could have industrialised the testing process in the way Iceland and the Faroe Islands have but “behaved like nothing was happening”.

eurativ.com, 7 April 2020

<https://www.eurativ.com>

This finding represents an important step in being able to reuse hard-to-recycle PU products.

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Polyurethane-eating bacteria to degrade hard-to-recycle plastic products

2020-04-06

The researchers from Helmholtz Centre for Environmental Research-UFZ have identified and characterized a strain of bacteria capable of degrading some of the chemical building blocks of polyurethane.

The bacteria can use these compounds as a sole source of carbon, nitrogen and energy. This finding represents an important step in being able to reuse hard-to-recycle PU products.

Bacterium Pseudomonas sp. TDA1

The team out of Germany managed to isolate a bacterium, Pseudomonas sp. TDA1, from a site rich in brittle plastic waste that shows promise in attacking some of the chemical bonds that make up polyurethane plastics.

The researchers performed a genomic analysis to identify the degradation pathways at work. They made preliminary discoveries about the factors that help the microbe metabolize certain chemical compounds in plastic for energy. They also conducted other analyses and experiments to understand the bacterium's capabilities.

High Solvent-tolerance

This strain is part of a group of bacteria that are well-known for their tolerance of toxic organic compounds and other forms of stress, according to Dr. Christian Eberlein with the Helmholtz Centre for Environmental Research-UFZ. He is a co-author on the paper who coordinated and supervised the work.

"That trait is also named solvent-tolerance and is one form of extremophilic microorganisms," Eberlein said.

P4SB Consortium to Bioconvert Oil-based Plastics

The research is part of a European Union scientific program dubbed P4SB (From Plastic waste to Plastic value using Pseudomonas putida Synthetic Biology), which is attempting to find useful microorganisms that can bioconvert oil-based plastics into fully biodegradable ones. As the name implies, the project has focused on a bacterium known as Pseudomonas

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putida.

In addition to polyurethane, the P4SB consortium, which includes the Helmholtz Centre for Environmental Research-UFZ, is also testing the efficacy of microbes to degrade plastics made of polyethylene terephthalate (PET), which is widely used in plastic water bottles.

Coding Extracellular Enzymes in Future

Dr. Hermann J. Heipieper, a senior scientist at the Helmholtz Centre for Environmental Research-UFZ, said *"the first step of any future research on Pseudomonas sp. TDA1 will be to identify the genes that code for the extracellular enzymes that are capable of breaking down certain chemical compounds in polyester-based polyurethanes."*

Extracellular enzymes, also called exoenzymes, are proteins secreted outside of a cell that cause a biochemical reaction."

"However, there is no immediate plan to engineer these or other enzymes using synthetic biology techniques for bioplastic production. That could involve, for instance, genetically converting the bacteria into mini-factories capable of transforming oil-based chemical compounds into biodegradable ones for planet-friendly plastics."

Heipieper said *"more "fundamental knowledge" like the one gathered in the current study is needed before scientists can make that technological and commercial leap."*

omnexus.specialchem.com, 6 April 2020

<https://www.omnexus.specialchem.com>

Lithium tipped for EU list of critical raw materials

2020-04-07

The soft, silvery-white alkali metal is expected to enter the EU list of critical raw materials later this year because of its strategic importance to the automotive industry, EURACTIV has learned.

Lithium will be added to the list alongside two or three other metals, according to an EU source with knowledge of the matter, who spoke to EURACTIV on condition of anonymity.

Lithium will be added to the list alongside two or three other metals.

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“Europe will require massively higher volumes of lithium for its battery revolution, but is highly dependent on supplies from elsewhere in the world,” says Guy Thiran from Eurometaux, a trade association.

Increasing home-grown production will strengthen Europe’s resilience to trade disruptions, he said, backing new initiatives to develop lithium mining and recycling activities in the EU.

Policymakers have stepped up plans to mass-produce batteries in Europe as the car industry rolls out new fully-electric models to comply with stricter CO2 emission standards.

Among the materials used in Lithium-ion battery cells, three are currently listed as critical raw materials by the European Commission: cobalt, natural graphite and silicon metal.

Although lithium is not in short supply, it has “an increasing relevancy for the Li-ion battery industry,” the EU executive said in a [report on raw materials for battery applications](#), published in 2018.

“Recognising the strategic role of lithium for the future European economy, and zero-emission mobility is important,” said Pia Alina Lange, head of communications at [Recharge](#), a trade association bringing together manufacturers of advanced rechargeable and lithium batteries.

Lithium supply currently not at risk

The [EU’s list of critical raw materials](#) was last updated in 2017. Raw materials that make it on the list are either considered highly important to the EU economy or have a high risk of supply shortages.

In the case of lithium, it is the first criteria that prevailed.

“Lithium would not fall under the definition of a classical CRM because it is neither scarce nor is the supply disrupted or at risk,” Lange said.

Indeed, European industries currently make a “relatively low” use of lithium at the moment, she says. What’s more, Europe has its own lithium reserves that are available for industrial-scale extraction, she points out.

“Having said so, lithium does play a significant role in the climate-neutrality and technological leadership objectives of the EU,” Lange told EURACTIV in emailed comments.

“It is an important raw material for the production of (EV) batteries, one of the six strategic value chains for the European economy. And with the

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European Battery Alliance, the European Union has clearly put a European battery manufacturing industry at the heart of its industrial strategy," she said.

As the electrification of road transport gained momentum, the Commission decided to launch a European Battery Alliance in 2017, bringing together automakers, chemical and engineering executives in a bid to compete with Asian and American manufacturers.

"We are working a lot on batteries and the discussions there focus on cobalt, lithium, nickel and copper," said Maroš Šefčovič, the Slovak commissioner who was then leading the Commission's flagship energy union project.

Mining and recycling

The European Commission was expected to update its list of critical raw materials in March, but publication was delayed because of more urgent priorities related to the coronavirus outbreak.

Still, Lange questioned whether lithium's classification as a critical raw material is the right way forward, citing Europe-based lithium reserves that can be opened for raw material extraction.

She also pointed to the future potential of recycling when it comes to EV batteries, saying the first wave of used batteries will start coming back in about 10 years.

"With the accelerated shift to zero-emission mobility, used batteries can and will play a much bigger role in secondary raw materials," Lange said.

For Eurometaux, the EU should support plans to develop mining in Europe as a way to strengthen the bloc's resilience to potential supply disruptions.

"That will require two main actions: investing into new sustainable mining opportunities and establishing the business case for recycling lithium from waste batteries," said Guy Thiran.

"We want to see a real ambition shift from Europe for all the metals required in higher volumes by the climate transition," he said.

eurativ.com, 7 April 2020

<https://www.eurativ.com>

South African scientists hope the resources and health networks built to fight those diseases will help them battle the new pandemic.

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South Africa hopes its battle with HIV and TB helped prepare it for COVID-19

2020-04-07

As the COVID-19 pandemic sweeps into South Africa, the decades the country has spent fighting the world's worst combined epidemic of tuberculosis (TB) and HIV could give it an advantage. But those infections could also worsen the pandemic's impact.

By 6 April, South Africa had 1686 confirmed COVID-19 infections, the highest number on the continent—and that is almost certainly an undercount. At the same time, **one in every five people aged 15 to 49 is HIV positive** and two to three people die every hour from TB. South African scientists hope the resources and health networks built to fight those diseases will help them battle the new pandemic. "The COVID-19 response draws on the same skills as TB and HIV," says Gavin Churchyard, director of the Aurum Institute, a Johannesburg-based research and health care nonprofit.

Infection control measures are similar for COVID-19 and TB, he points out, because both seem to spread through exhaled droplets. That means health care workers are familiar with the protective gear they need to treat suspected COVID-19 patients. And South Africa's government is repurposing the aggressive "find, treat, and prevent" strategy that's key to its HIV response, Churchyard says. It began to send mobile COVID-19 testing clinics into densely populated areas this week to identify cases and contacts.

His institute has "massively slowed down" its regular research activities, stopped recruiting patients into clinical trials, and mobilized its 3000-strong staff—80% of whom are frontline workers—to help national COVID-19 testing and contact tracking efforts. Aurum's researchers also plan to study treatments and vaccines and will monitor how well South Africa's COVID-19 response is working, Churchyard says.

The African Health Research Institute (AHRI) in Durban, South Africa, which normally focuses on HIV and TB, has redeployed its entire infrastructure and staff to fight the pandemic. It has made its mobile clinics, community workers, and labs available for coronavirus testing, and its researchers will **help run a trial** to see whether chloroquine can protect health care workers. Funders—which include the Wellcome Trust and the Howard Hughes Medical Institute—have been "astonishingly flexible," says AHRI Director Willem Hanekom.

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COVID-19 is just beginning to take a toll across Africa, but South Africa and many other countries have already instituted local or nationwide lockdowns. Many countries face the question of whether existing illnesses will worsen the pandemic's impacts. In South Africa, two national surveillance sites, one run by AHRI and the other by the South African Medical Research Council and the University of the Witwatersrand, will screen 40,000 households in areas with high rates of TB and HIV. Researchers hope to learn whether HIV positive people have impaired immunity to the new coronavirus, and how lung damage from TB might influence disease outcome. They will also investigate the impact of the nationwide lockdown on rural households, as well as on mental health, says Kobus Herbst, who heads the South African Population Research Infrastructure Network, which includes Aurum and AHRI.

A Cape Town, South Africa, laboratory run by the Desmond Tutu HIV Foundation is also joining the effort. The lab studies how TB is transmitted by putting patients in phone booth–size rooms and sampling their exhaled air for microorganisms. It is planning to see whether the same technique can detect the new coronavirus, which could yield a way to diagnose asymptomatic COVID-19 cases, says foundation leader Robin Wood. "I do think our observations of transmission of TB and COVID-19 will have comparative relevance," he says.

Churchyard thinks South Africa is in for a rough ride. Despite the millions spent fighting TB and HIV, the death toll from both remains among the highest in the world. "Just having this technical capacity does not guarantee that we will contain this new epidemic," he says.

For him, the disease has already hit home. Last week, Aurum senior researcher and HIV prevention stalwart Gita Ramjee became one of the first people in South Africa to die from COVID-19. That was a heavy blow, Churchyard says, but it galvanized him and his colleagues. "Gita was a fighter. She would want us to be out there doing what we can."

sciencemag.org, 7 April 2020

<https://www.sciencemag.org>

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Curiosities

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Romania bans exports of cereals, energy firms' sales

2020-04-10

The Romanian government has decided to ban exports of wheat, corn, rice, sunflower and other grains, but also vegetable oil, sugar and various bakery products for as long as the Covid-19 state of emergency is in force.

Romania is one of the largest exporters of cereals in the EU, selling to both European states and other markets such as Middle East countries. In 2018, Romania exported 12 million tons of cereals.

The ban is applied to all exports, but intra-EU acquisitions are allowed on condition that the destination country proves that the products are for internal or EU consumption and not redirected to third countries. In a sign that the government is determined to ban exports, it also announced that the authorities will no longer issue phytosanitary certificates that are used for exports.

Yet, the sale of majority stakes in companies included in the National Energy System is forbidden during the state of emergency period. Both decisions were included in a military ordinance announced late Thursday and they will apply after the publication in the Official Journal.

It is still unclear why the government decided to ban sales of energy firms. In the past, China partnered with Romanian state companies to build new energy production units at existing power plants. However, nothing has moved on so far.

In late March, the European Commission issued guidelines calling on member states to make full use of foreign investment screening mechanisms to protect Europe's critical infrastructure in times of economic instability and fragility.

The Czech ČEZ energy group, which holds a number of assets in Romania, recently announced plans to focus more on the domestic market and sell foreign assets. The company said many investors expressed their interest, including Romanian, but for now, no sale can move forward.

[eurativ.com](https://www.eurativ.com), 10 April 2020

<https://www.eurativ.com>

The Power of Parks in a Pandemic

2020-04-09

Parks aren't usually in the news this much.

**In 2018, Romania
exported 12 million
tons of cereals.**

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With half of the world now living under lockdown, the ability to go outside and get some fresh air has never been so important, or so fiercely contested. As those who can afford to do so converge on green spaces, seeking exercise and solace amid the coronavirus pandemic, parks have become stages for collective joy, anxiety, and social-distancing infringement crackdowns. The multiplicity of benefits parks have always offered us — physical and mental health relief, community building, and free public open space in tight, increasingly privatized urban quarters — seem not only like an added bonus right now, but rather, a critical lifeline for cities and their residents.

Between 2017 and 2018, I researched and visited 65 of New York City's parks in a policy report assessing their state and potential problem areas for the Center for an Urban Future. This kind of mass recognition of parks as critical urban infrastructure was something park advocates always wanted, and hoped to encourage. None predicted that it would take a global pandemic for that to finally happen. But the Covid-19 era is also emphasizing something I found in my research: Parks haven't gotten the attention in dollars that they deserved in the years leading up to this crisis. Now we're seeing the consequences.

The coronavirus crisis, to me, highlights three key gaps in parks equity that cities will need to address once this is all over: accessibility, funding, and space.

Accessibility

As Alisa Walker recently pointed out in Curbed, a glance at Covid-19-era social media might lead you to believe that everyone had access to a garden, nature trail, or an Instagram-worthy weeping willow. That's not the case: In the U.S. alone, 100 million people (28 million children included) do not have a neighborhood park within a 10-minute walk from home. And now that trails and parks are closing in state, county, and national parks (in the U.S., but also in countries like Canada, Scotland, etc.), and parking constraints to reduce crowding, this systemic lack of local green space is stark.

That search for space is incredibly apparent in London, where I'm currently studying. In October of 2017, the city released a report touting the economic value of parks: For every pound spent on parks, it said, the return to the taxpayer was 27 pounds, when you add up the health and air pollution savings with the effects on property values. Mayor Sadiq Khan has made green space a priority, seeking to squeeze in streetside trees and rain gardens in a city known for its private parks. But still, who has access

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to that 27 pounds worth of benefits persists, if not worsens, in pandemic times.

In a game of “tutting,” or social reprimanding of park users, local councils have made efforts to close two sizable green spaces: Victoria Park and Brockwell Park. (Brockwell has since reopened; Victoria will reopen on April 11.) The tourist-famed Royal Parks have been threatened to, as well. The low-income borough of Tower Hamlets, home of Victoria Park (which was first built as a public health measure against disease), has one of the worst air qualities in London, and its parks fall victim to this pollution. Yet Tower Hamlets only has 300 hectares of park space, for a little over 317,000 people; without Victoria Park, that number drops down to about 214 hectares. (The borough of Lambeth, home to Brockwell Park, faces a similar dilemma.) For comparison: Kensington, a wealthier borough, has 200 hectares for about half the population, and less land mass.

So what little space is left to occupy? And with public transport reserved for front-line workers, how does one even get there?

Funding

One thing I heard consistently from park workers, volunteers, and advocates during my research was to look beyond the statistics: Even if you have a park within 10 minutes of your home, that doesn't necessarily mean much if the park or playground is not well-maintained or well-designed. I found that to be the case across the board: The average New York City park, for example, is 73 years old, and last saw a major renovation in 1997. At least 20% of the city's parks hadn't seen a renovation in 25 years. Issues like clogged drainage, broken comfort stations, and vulnerable bridge structures were the most apparent.

Where do we see that happening? In working-class communities, the ones now hit hardest by the pandemic. In Woodside, Queens — which lies within the radius of the virus's epicenter — 45% of parks hadn't received a major renovation since 1993. Overall, Queens has six parks that haven't been renovated in over 100 years, and 31 in over 50 years. The borough's largest park, Flushing Meadows-Corona Park, which serves the city's most vulnerable neighborhood, is prone to flooding and cracked pavement.

This inequity, which persists in plenty of city parks systems around the world, specifically derives from the ways in which private wealth and public dollars function. Under local rule, priorities like community safety or health take budgetary precedence in low-income areas, which places parks down the list of spending priorities. Meanwhile, marquee parks

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in highly visible locations (think: Central Park and the High Line) usually have conservancies backed by rich neighbors, affording them amenities like [Beaux Arts bathrooms](#) and high-quality landscape care. So what you end up having is the 834-acre Central Park with a 125-person private staff (when the report was published), while the city at large has only about 150 public gardeners, for nearly 20,000 acres of green space, and limited specialized workers throughout the boroughs.

Most of the parks in desperate need of renovation were small neighborhood green spaces, like triangles, plazas, and gardens. But as we've seen, these are the open spaces we're now relying on the most during the pandemic. Especially when the big parks fill up.

Space

After discussing who can access parks, and what parks get funding, it's worth finally considering the actual space within or around those parks.

It's no surprise that the movement to reclaim streets from now-scarce vehicles that is currently attracting attention in cities across the globe (as CityLab's Laura Bliss [mapped](#) last week) has also targeted parks. When public space gets tight, we're more likely to realize what takes up a lot of it. And in many urban parks, car space still dominates.

Portland has closed [10 of its parks](#) off to cars and trucks, in an effort to promote social distancing and ease overcrowding. Minneapolis-St. Paul [continues](#) to open up parkways to pedestrian and cycling traffic, and [close roads](#) around park edges and bodies of water. All roads within Vancouver's Stanley Park are now [car-free](#). The same pattern can be seen in cities like [Philadelphia](#), [Cleveland](#), and [Denver](#). Seemingly overnight, acres of park space have been added to urban landscapes, without spending a single city dollar.

One statistic that [always stuck out to me](#) during my research is the fact that urban green spaces function as the primary source of natural recreation for about half of New Yorkers. Now we've entered a period when more city dwellers, confined to their homes, are appreciating that space together. In Philadelphia, community gardens and urban farms have been [deemed](#) "essential" services. In Calgary, gardening stores are being [swarmed](#) with calls. And trails are seeing visitorship [double](#) from this time last year. (Again: with social distancing measures in mind.)

In a [quick Twitter survey](#), I asked users if they've discovered new parks in their backyard during self-quarantine, or rediscovered parts of old ones.

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People in Charlottesville, Harlem, and other parts of London told me that neighbors were using previously defunct spaces, venturing to ones off-road themselves, or exploring in their neighborhood for the first time. (In Oxford, UK, where I currently live, I've found a few uncharted trails myself.)

The Covid-19 pandemic should reawaken interest in parks and open spaces long overlooked by city officials, or unnoticed by city residents. Beyond that, this crisis should refocus attention on the deficiencies in green space and contact with nature at the hyper-local level. And, hey, maybe the space that does exist shouldn't go to cars.

But it's not yet clear if the critical importance of urban parks that the pandemic has revealed will be accompanied by resources to support these spaces. Pushed by an alliance of union workers and advocates, our report garnered an unprecedented infusion of money (\$43 million, to be exact) into New York's parks last year, building upon the administration's initiative to fund community parks. A second-year push was in the works. But what happens now? We have now undoubtedly entered uncertain economic times, and city budgets will tighten. Parks are often the first to get cut in recessions. (In fact, Mayor Bill de Blasio is now proposing \$18.1 million in parks cuts.)

A more robust effort to support parks that doesn't include a significant burden on taxpayers is the new reality we face with. So now is the time for cities to get creative with funding mechanisms. Our report recommended a number of revenue streams, including small surcharges on sports events and concerts (when they reopen), golf course fees, and the mandatory inclusion of green space in rezoning efforts. But there is much more out there to consider, especially in this brave new world we're living in.

The Covid-19 pandemic has many lessons to teach us, and how cities rethink infrastructure in the days ahead will be one of the greatest tests of urban resilience. Let's not let parks be one we forget.

citylab.com, 9 April 2020

<https://www.citylab.com>

Animal viruses are jumping to humans. Forest loss makes it easier

2020-04-09

The destruction of forests into fragmented patches is increasing the likelihood that viruses and other pathogens will jump from wild animals

“We see the animals as infecting us, but the picture that’s coming from the study and other studies is we really go to the animals,” said Dr. Lambin. “We intrude on their habitats.”

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to humans, according to [a study from Stanford University](#) published this month.

The research, which focused on contact between humans and primates in western Uganda, holds lessons for a world reeling from the coronavirus outbreak and searching for strategies to prevent the next global pandemic.

“Covid has taught us that once a pandemic starts, it’s very hard to control,” said Laura Bloomfield, a doctoral candidate at Stanford and the study’s lead author. “If we can decrease the potential for people to come into contact with wild animals, that is one way to decrease the likelihood of having recurrent pandemics.”

In Uganda, a rapidly growing population means more people are carving out patches of forest land to feed their families.

Humans have already claimed [more than a third of the Earth’s land](#) for agricultural use. [Tropical forests are being destroyed](#) at record or near-record rates every year. In places like the Amazon and Indonesia, for instance, virgin rain forest is being burned to farm commodities like soy, palm oil and cattle. Recently, deforestation in the Brazilian Amazon has [risen sharply](#) under the government of President Jair Bolsonaro.

Eric Lambin, a professor of Earth system science at Stanford and one of the study’s co-authors, said that the United States has its own example of an animal-borne disease linked to patchwork woodlands close to suburban and rural communities: Lyme disease, which spreads from wildlife to humans by ticks.

“We see the animals as infecting us, but the picture that’s coming from the study and other studies is we really go to the animals,” said Dr. Lambin. “We intrude on their habitats.”

Smoldering forest and peatland next to a palm oil plantation in Kamipang, Indonesia, last year. Credit...Ulet Ifansasti for The New York Times

In Uganda, researchers combined satellite data with face-to-face surveys of more than 900 people near [Kibale National Park](#), analyzing the geographic factors and behavioral traits that led to increased physical interactions between humans and wild primates.

Among the human-primate contacts recorded: A boy digging in his family’s garden was bitten by a black-and-white colobus monkey. A young man foraging for timber in the forest tried to free a l’Hoest’s monkey from

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his dog's jaws. A woman found a dead vervet monkey in her corn crops and cleared its body away.

Each of these interactions offered viruses an invitation to jump from wild primates to humans.

While the researchers expected to see the highest contact near the most robust habitat and densest primate populations, they found the opposite: Dwindling islands of forest, left as people moved in around wild primates, led to more interactions between humans and primates. People ventured into the forest in search of wood for construction or food, and monkeys and chimpanzees ventured out to feast on crops.

"They were able to measure it explicitly, which was great," said Sadie J. Ryan, an associate professor of medical geography at the University of Florida who did not participate in the Stanford study.

Large, healthy and diverse habitats with fewer borders on human populations would help, the researchers said, coupled with economic development so that families would not have to take over forest land for subsistence farming.

Another study this month, published in Proceedings of the Royal Society B, took a broader look at zoonotic diseases and supported the idea that disease spillover was connected to the likelihood of human-animal interactions.

Infectious diseases have been plaguing poor and marginalized people for a long time, Ms. Bloomfield said. "It is a shame it took such a devastating disease for the public to finally take notice."

[nytimes.com](https://www.nytimes.com), 9 April 2020

<https://www.nytimes.com>

Now more than ever it seems we can't live without plastic. Can we learn to live with it?

2020-04-10

In September 2019, more than 72,000 people gathered at beaches, streets, offices and parks in 51 countries around the world. At nearly 500 different sites, they picked up plastic litter. Volunteers tallied the type of product, the variety of plastic and any brand names they could identify.

All together the participants, working with a coalition of groups called Break Free From Plastic, collected more than 475,000 bits and hunks of plastic trash.

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All together the participants, working with a coalition of groups called Break Free From Plastic, collected more than 475,000 bits and hunks of plastic trash. Results from these cleanups appeared a month later in a report published by Greenpeace Philippines.

Plastic is everywhere. It makes health care cleaner and safer, helps some disabled people live more independent lives, preserves safe and affordable food and — since it weighs less than many materials — can cut down globe-heating carbon emissions in transportation.

But plastic trash, too, is everywhere. While tiny microplastics permeate the world unseen, larger pieces litter once-pristine beaches, kill iconic ocean animals like sea turtles and undermine important ecosystem services, including tourism and fisheries — for a total marine economic impact of around US\$8 billion each year. On land, plastic particles pollute soil, sneaking into food chains and leeching toxic chemicals into groundwater. Persisting in the environment, most plastics never really break down on their own.

Then there's climate change. Most of the raw materials marshaled to make plastic are fossil fuels. Add in energy use for manufacturing, and plastic production alone accounts for 8% to 9% of oil and gas used worldwide. Disposal is a climate challenge, too. One report released last month analyzed plastic trash from four companies burned in six countries, which they found accounted for 4.6 million metric tons (5 million tons) of carbon dioxide equivalent emissions.

Break Free From Plastic snapshots one sliver of this challenge. The group's effort looks at litter and pollution — the never-ending endpoint of plastic's long life — and the report acknowledges that its cleanup sites weren't spread evenly over the globe.

But among the many brands identified at those sites, those of three multinational corporations top the list: Coca-Cola, Nestlé and PepsiCo. People buy products packaged in plastic, but businesses like these put those products on shelves in the first place. The other companies in the report's top 10 are Mondelēz International, Unilever, Mars, P&G, Colgate-Palmolive, Phillip Morris and Perfetti Van Melle.

Some of these companies have pledged to produce more recyclable plastic and cooperate with international efforts for sustainability. Other firms have been more mum. But as plastic keeps piling up around the world, prickly questions top the mounds of trash: Are these commitments genuine? Can voluntary moves by big business tackle the plastic problem?

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And if not, what on Earth can we do?

Big Promises

According to a [report](#) from the World Economic Forum published in 2016, packaging is the biggest use of plastic, at 26% of the material's volume worldwide.

Coca-Cola, Nestlé and PepsiCo are among the more than 200 companies that have signed the voluntary [New Plastics Economy Global Commitment](#), which was launched in 2018 as a partnership between the United Nations Environment Programme and the Ellen MacArthur Foundation. Under the commitment, companies selling packaged goods promise that 100% of their plastic packaging will be "reusable, recyclable, or compostable" by 2025. Three other companies in Break Free From Plastic's top 10 list — Unilever, Mars and Colgate-Palmolive — also signed on.

The commitment isn't just a series of promises. It requires businesses to track their progress and report back. While the Ellen MacArthur Foundation did not independently confirm the numbers disclosed by signatories, Iulia Strat, a spokesperson for the foundation, says that its [New Plastics Economy](#) team "challenged companies on submitted information when it was unclear or incomplete."

"This level of transparency on plastics has not been achieved previously," Strat wrote in an email to Ensia.

These companies are making a lot of their packaging recyclable, according to the commitment's [latest progress report](#). PepsiCo, responsible for 2.3 million metric tons (2.5 million tons) of plastic packaging each year, reports that 77% of that packaging is reusable, recyclable or compostable. For Nestlé, that number is 65% of the annual 1.7 million metric tons (1.9 million tons) of plastic it uses to package products, including bottled water, chocolate bars and Purina pet food.

These data are self-reported, though, and it's not always clear exactly which part of a company's product portfolio the published numbers apply to. In numbers disclosed to the New Plastics Economy team, Coca-Cola stated that 99% of its primary packaging is reusable, compostable or recyclable, a figure not meant to include transit packaging such as shrink films and later clarified to mean only PET plastic bottles.

Coca-Cola spokesperson Scott Leith said the company is preparing to assess and disclose numbers for non-bottle packaging, but did not provide

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a timeline for that disclosure. Coca-Cola, which Break Free From Plastic identified as the company whose plastic showed up the most in the environment, produces 3 million metric tons (3.3 million tons) of plastic PET bottles each year, making it the biggest plastic producer among the consumer goods companies that have signed the commitment.

Big Problems

Being recyclable is not the same thing as actually getting recycled. A 2017 study in the journal *Science Advances* estimated that just 9% of all plastics ever made have actually been recycled. The rest has been burned or, mostly, left to pile up in landfills, spill into soil and stream into seas.

As major signatories to the commitment make more of their packaging recyclable, they're largely not using recycled material in their own production. Instead, when making bottles and wrappers and other packaging, these companies mostly rely on new plastics derived directly from fossil fuels. Per the commitment's progress report, Coca-Cola's plastic packaging contains 9% recycled content. For PepsiCo and Nestlé, that number is 3% and 2%, respectively. All three companies say they aim to use more recycled content over the next 5 to 10 years.

Part of the problem is that it's difficult to recycle plastic and get material that's safe enough to hold food and drink. Most of the pieces of trash scooped up by Break Free From Plastic volunteers (at least of the chunks they could identify as a particular type of plastic) were polyethylene plastics, including the common polyethylene terephthalate (PET), with polypropylene — another plastic commonly used to package food — coming in a distant second place. While it's possible to recycle polyethylene and polypropylene, special processing is necessary to ensure these materials are free from contaminants if they are to be used to store food. That comes with a cost.

"Some plastic suppliers are willing to invest in developing new processing capacity but are waiting for clear commitments from material buyers to do so," a spokesperson for Nestlé who asked not to be identified wrote in an email to *Ensia*. In January, the company announced that it would spend 1.5 billion Swiss francs through 2025 to "pay a premium" for food-grade recycled plastics.

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Nestlé's pledge, the spokesperson wrote, "creates a business case for our suppliers and secures their investment. Recycling PP [polypropylene] and PE [polyethylene] becomes financially attractive." Over the next five years, Nestlé says it will source up to 2 million metric tons (2.2 million tons) of food-grade recycled plastic. The company did not disclose to Ensia any of the plastic suppliers it plans to work with.

The New Plastics Economy Global Commitment also calls for companies to ditch "unnecessary" plastic packaging and move from single-use to reuse of plastic, although businesses aren't held to any particular targets on those fronts.

"Signatories work to address the root causes of plastic pollution, and recognise that this vision will require significant effort and investment from both business and government," the Ellen MacArthur Foundation's Strat wrote to Ensia. "We need to go beyond increasing recycling capacity, and match those efforts with similar investment and ambition levels across the full range of solutions, including elimination and reuse."

But even companies that have joined the commitment have no current plans to abandon plastic entirely. For example, in January at the World Economic Forum in Davos, Beatriz Perez, Coca-Cola's head of communications, public affairs, sustainability and marketing assets, said the company will not move away from single-use plastic bottles because people like them.

Three of the top 10 companies identified by Break Free From Plastic have not signed on to the Commitment at all: P&G, Phillip Morris International and Perfetti van Melle.

P&G, an Ohio-based multinational that sells a range of consumer goods from Pampers diapers to Tide laundry detergent is pledging 100% reusable or recyclable packaging by 2030.

Neither Mentos-maker Perfetti Van Melle nor cigarette-seller Philip Morris have announced any specific targets for more sustainable plastic. In a statement to Ensia, Jens Rupp, head of environmental sustainability for Philip Morris International, highlighted the company's environmental statement. Focusing on the actions of individual consumers, Rupp wrote that Philip Morris is "taking steps to reduce cigarette butt littering through ambitious anti-littering campaigns."

Perfetti Van Melle's group communications director, Stephanie Creech, wrote in an email to Ensia that many of the company's plastic containers

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are recyclable, encouraging customers to properly recycle them. “We continue to seek alternatives to plastic packaging while ensuring that we still deliver product freshness to our consumers,” she wrote.

PepsiCo, which has signed the commitment, did not respond to repeated requests for comment on this story.

Mondelēz International — whose brands include Honey Maid graham crackers, Chips Ahoy cookies and the candy Sour Patch Kids — had previously set its own goal of 100% recyclable packaging by 2025. The company signed the commitment in March 2020.

Government Efforts

Even with recent initiatives such as the New Plastics Economy Global Commitment, the world continues to make new plastic. Since 2010, petrochemical companies have invested some US\$200 billion in plastic production, and one market research firm estimates that the global market for plastic packaging isn’t on track to shrink, but is in fact set to grow by an average of nearly 4% each year through 2025.

“At the same time as you have some countries and companies working towards this voluntary initiative, you also have companies lobbying against legislation to restrict packaging, and you also have massive investments still being made in the industrial complexes that create plastic,” says Elizabeth Kirk, a professor at the University of Lincoln who studies international law and marine governance. She says that voluntary commitments are not enough.

In the past year, some countries have moved to mandate plastic reduction. In March 2019, the European Union voted to phase in a ban on many single-use plastic items including cutlery, straws and stirrers. The law includes a provision that plastic bottles must be made of at least 25% recycled content by 2025. This January, China unveiled a new policy to phase in a ban on single-use plastic bags, straws and packaging over the next several years.

In the United States, some individual cities and states have passed legislation to limit certain single-use plastics. At least one major company supports one of these efforts: In Maine, Nestlé Waters North America is supporting a bill that would set legal minimums for recycled content in plastic bottles. At the federal level, legislators in February introduced a bill that, if passed, would phase out some single-use plastics and raise the required recycled content in plastic beverage containers. Last year during

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a visit to an under-construction plastics plant in Pennsylvania, President Donald Trump blamed other countries for the ocean plastics problem. But in March, the Department of Energy announced up to \$25 million in funding for research and development on plastics recycling.

A Global Challenge

Rich nations like the U.S., the United Kingdom and Australia have shipped millions of tons of their plastic waste to Asia. China, once the destination for much of the plastic waste exported out of the U.S., severely restricted its waste imports in 2018. After that, the U.S. began channeling more plastic trash to Thailand, Malaysia and Vietnam.

Last year the Basel Convention, a multilateral agreement governing international disposal and management of waste, was amended to include plastic waste. Under the new rules, countries seeking to export contaminated or unrecyclable plastic trash must get approval from the receiving country's government before shipping the garbage to private disposal companies. The U.S. is not a party to the convention.

To address the global problem of plastic, Kirk says that we need a global treaty specifically dedicated to it. A "plastics convention" with binding commitments for countries that sign it might provide a framework for fighting marine pollution and lowering greenhouse gas emissions. She points to other environmental treaties as examples of this approach: The Stockholm Convention has successfully reduced persistent organic pollutants (POPs), while the Montreal Protocol facilitated worldwide regulation of aerosols and effectively saved the ozone layer. The UN Framework Convention on Climate Change has arguably been far less successful so far, but Kirk notes that it has probably helped bring more media attention to climate change.

"A treaty can also provide a signal to industry," Kirk says. By phasing in global regulations, a plastics treaty could give companies the incentive to innovate more quickly.

But Kirk cautions that a treaty, like any plastics policy, would need mechanisms to account for particular uses and needs. Plastics are ingrained in our society, so sustainability is no simple task.

While many headlines point to strangled sea turtles and giant garbage patches, other harms fly more under the radar, including the fact that poor nations face the brunt of human impacts from the throwaway plastic of rich countries like the U.S.

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At the same time, scientists have yet to make the major breakthroughs needed to replace conventional plastics. Plastics designed to be compostable or biodegradable often require special processing facilities, or at least particular natural environments such as warm waters, outside of which they're often a persistent pollutant like conventional plastics. Plastics made at least in part from feedstock other than fossil fuels, meanwhile, might contribute to deforestation and other harmful land uses.

It's not as simple as ditching plastics entirely, either — not without massive, systemic changes in the global economy. Plastic packaging, for example, helps keep food safe over the long distances inherent in today's supply chains. Single-use plastics also enable lab research by scientists: petri dishes, pipettes, vials, gloves and more. Glass could likely take plastic's place in some cases, but not without a difficult transition.

And people with some physical and cognitive disabilities rely on plastic products, according to Andrew Jenks, a Ph.D. candidate in political science at the University of Delaware. He co-authored a recent policy studies paper that urges decision makers to consider how societies can address the problems posed by plastics without putting responsibility on individual consumers, particularly disabled people.

Plastic straws, for example, are key in helping people with some physical and cognitive disabilities consume drinks and medicines, he says, while plastic food containers are essential for some disabled people to live independent lives.

"That is an issue that is in some ways not up to the choice of the individual consumer or user who has a disability," Jenks says. "Because in reality, they're just trying to survive."

Survival is also at stake in healthcare, where plastics appear in gloves, syringes, sterilization wraps and many medical devices.

Recently, with the novel coronavirus spreading around the world, manufacturers are rushing to make more ventilators to treat Covid-19 patients — ventilators that use plastic in parts such as breathing tubes. In Italy, one company made headlines around the world when it used a 3D printer to produce plastic ventilator valves for a hospital that had run out of them.

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Proposed solutions exist to up recycling in medical contexts, but it's no simple task, with one estimate saying that plastics account for 25% of waste from hospitals.

As producers have made more and more plastic nearly every year since 1950 — with 381 million metric tons (420 million tons) created in 2015 — the material has shaped the world we know. Today, plastic is everywhere.

Tomorrow, if we choose, that might change. But such change will come with nuance and challenge. It will transform corporations and consumers, governments and citizens, producers and people.

ensia.com, 10 April 2020

<https://www.ensia.com>

The mysterious demise of freshwater mussels

2020-04-13

Anthony sasson knew something terrible had happened in Ohio's Big Darby Creek.

Ordinarily, Big Darby cradles 44 of Ohio's 60 or so species of freshwater mussels. But in October of 2016, Sasson, then a biologist at the Nature Conservancy, was one of the first people to notice mussels emerging from the safety of their usual burrows in the creek bed. The die-off was so extensive he could wade into the protected waterway, reach down, and collect a dead or dying mussel with every step. That fall, thousands of mussels — including two federally-endangered species — perished without warning or explanation.

At first, it looked like the result of a toxic spill — except all the fish and other aquatic life seemed fine. Early water and tissue analyses ruled out contaminants, algal toxins, parasites, bacteria, fungi, and other pathogens. "We really don't know what's happening," a U.S. Fish and Wildlife Service employee said at the time. A month later, one of her colleagues expressed doubt they ever would. Biologists returned to document the die-off's survivors, but even today they still don't know the cause or the extent of the one-time event's drastic toll. "It's an enigma," Sasson said.

In North America, home to one-third of the world's freshwater mussel species, more than 70 percent of the mussels are imperiled or have been driven to extinction by pollution, habitat destruction, and other

That fall, thousands of mussels — including two federally-endangered species — perished without warning or explanation.

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human-made hardships. But mass mussel casualties like those in Big Darby are relatively new, and they are happening worldwide. Around the same time as the Ohio incident, thousands of mussels were mysteriously perishing in Tennessee's portion of the Clinch River, which runs through the Great Appalachian Valley. And over the last decade, similar die-offs from Washington to Wisconsin to Virginia — and overseas in Spain and Sweden — have perplexed biologists. "These are scary and disturbing," said David Strayer, a retired freshwater ecologist formerly with the Cary Institute of Ecosystem Studies, an environmental research nonprofit in New York State. "Because we don't really know what's going on."

On the case is the somewhat facetiously named Unionid Mussel Strike Force, a collaboration of two researchers at the University of Wisconsin-Madison and a half-dozen other scientists from a handful of federal agencies around the country. But in addition to trying to solve a mystery, the Strike Force is struggling against another obstacle long familiar to mussel specialists: apathy.

"It's hard to rally around a living rock," said Jeremy Tiemann, an aquatic ecologist with the Illinois Natural History Survey and president of the 550-member Freshwater Mollusk Conservation Society. Even though mussels are largely responsibly for filtering and cleaning freshwaters worldwide, it's not easy to foster human compassion for them, added Jordan Richard, a U.S. Fish and Wildlife Service biologist and Strike Force member.

Still, in many of the country's freshwater creeks and rivers, that foundation has been long crumbling. As early as 2004, Ohio ecologists began sounding alarms about declines in the richness of mussels in Big Darby Creek. The long decline, and the more recent decimations, could point to a broader ecological collapse. "I tell people freshwater mussels are not the charismatic megafauna," the late Ohio State mollusk curator Tom Watters told Columbus Underground magazine in 2019. "They're not cuddly or majestic or cute." But mussels, Watters continued, "are the canaries in the coal mine."

Freshwater mussels — distinct from the farmed saltwater varieties typically found on dinner plates — occupy the intersection of water and soil, making them precious to both aquatic and terrestrial ecosystems. As filter-feeders, mussels can digest bacteria like *E. Coli* and other contaminants from the currents they bathe in, including the pharmaceuticals we flush down our toilets and the herbicides we apply

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to our lawns. What mussels ingest, they break down; some of it they release, and the rest they store as nutrients in their soft tissue and shells. These nutrients include carbon, which the mussels can sequester for the entirety of what is, at least for some species, a century-long life, making them at least a small player in mitigating climate change. In death, mussels still play a role in the ecosystem, feeding muskrats, raccoons, and other riverside vertebrates.

In some cases, humans have harnessed the shellfish's ability to filter water. In 2019, for example, Pennsylvania invested \$7.9 million in a mussel hatchery in Philadelphia aimed at improving water quality in the Delaware and Susquehanna watersheds, which together provide drinking water to more than 25 million people. In fact, most water bound for our reservoirs and faucets has probably passed through the interior of a freshwater mussel, according to veterinarian Abbie Gascho Landis' 2017 book, "Immersion." "They belong to both landscape and liquid," she wrote. "As part of the river's viscera — tucked among its bones — mussels are vital to the living river, and they cannot survive without it."

Today, North America's 300-or-so freshwater mussel species go by their common names, which range from the delicate — pheasantshells, finelined pocketbook, downy rainbow, and fragile papershell — to the rude — elephant-ear, monkeyface, heelsplitter, orangefoot pimpleback, and fuzzy pigtoe. They can be as small as a quarter or as large as a Frisbee, their shells as thin as a dime or as thick as a finger.

Regardless of size or species, every stage of a mussel's life cycle reveals the precariousness of the animal's conditions for survival. To feed, mussels demand water of a certain quality. To reproduce, they need a strong current to carry a flotilla of sperm to a potential mother. Most larval mussels are parasitic and hitch a ride to their future homes on fish, a feat only possible in healthy river ecosystems. Later, young mussels need an intact creek bed where they can mature into adults.

Mussels also don't have much of a defense system and "they're terrible at escaping," Sasson said. The creatures are vulnerable to whatever gets dumped in waterways, he added, and they "are not really prepared to deal with modern insults."

Freshwater mussels are even finicky in sickness and death. Monitoring a mussel's health is near-impossible, said Tony Goldberg, a veterinary epidemiologist at the University of Wisconsin-Madison and a Strike Force member. Prying the shellfish open can be lethal. And there's not much in the way of external symptoms to examine. Goldberg can't easily draw a

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mussel's blood or inquire about its diet, like he would do with a dog or cat. "You can't listen to their heartbeat or take their temperature," he said. "The best indicator that a mussel is sick is that it's dead."

In the United States, humans have driven a lot of mussels to death over the last century. Until the recent mysterious mass die-offs, scientists could explain much of freshwater mussels' drawn-out decline dating back to the mid-19th century, when people realized they could yield pearls and their shells could be turned into iridescent buttons. By 1900, prospectors had rushed from the Northeast to Arkansas, Wisconsin, Louisiana, and Texas, depleting wild mussel populations along the way. (In a twist of fate, Johan Boepple, father of the U.S. mussel-shell button industry, stepped and cut his foot on a heelsplitter and died from an infection in 1912.)

Overexploitation and the rise of zippers and plastic fasteners brought the pearl button industry to its end in the early 20th century, but a new threat to mussels soon emerged. From the mid-1920s to the mid-1980s, dam construction across the U.S. impacted all but 2 percent of the country's total stream length, Gascho Landis wrote. To date, most of the continent's extinction of mussel species are directly attributable to dam-related habitat destruction. In one instance, a single dam on the Coosa River in Alabama drove six species of mussels out of existence.

One-time pollution episodes left further pockmarks in the nation's mussel beds. In 1998, for example, an overturned tanker dumped 1,350 gallons of a rubber accelerant into an unnamed tributary of Virginia's portion of the Clinch River. That morning, seven miles of its water turned milky with chemicals, killing some 18,000 mussels. Virginia's game and fisheries agency considers the event "the most significant kill of endangered species in the history of the U.S. Endangered Species Act of 1973."

By the 1980s North America's mussels faced a new danger: invasive mollusks, which arrived from overseas and competed with native mussels for food and other resources. Around 1986, zebra mussels arrived through shipping into the Great Lakes and spread across the country, joining Asiatic clams, also known as Corbicula, which by then had already spread to D.C. and at least 37 states.

Michael Hoggarth, a biology and earth science professor at Otterbein University, has been doing mussel surveys in Ohio's Little Miami River and its tributaries since 1990. By revisiting the same spots since then, he's been able to track the disappearance of mussels from the river system over three decades. "It's somewhat unique to document the decline," said Hoggarth. At one site, for example, he initially recorded 90 live shells

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across 12 species; last year he found just 11 live ones representing half as many species. “We’ve lost almost all the mussels,” he said.

Other researchers have also recorded a nationwide deterioration of freshwater mussel populations over the last half-century, from the Embarras River in Illinois to the Conasauga River in Georgia. One of them, Wendell Haag, a scientist for the U.S. Forest Service in Frankfort, Kentucky, also wrote the textbook on North America’s freshwater mussels. “I say I got into mussels at the right time, because I got to watch them all die,” he said. “It’s depressing.” The line between historic declines and modern die-offs is fuzzy, Haag said, since the death of a mussel almost always goes unwitnessed.

“These impacts are slow and insidious, and they’re cumulative,” Hoggarth said. “If mussels are dying, they are a harbinger of what’s happening to that water. If you have dead mussels — or no mussels at all — that’s not a good sign.”

THE UNIONID MUSSEL Strike Force is a team of experts prepared to pounce on the next investigation, wherever it might take place (unionid refers to a family of freshwater mussels common in the U.S.). Based in Wisconsin, its core group of scientists stand ready to store and analyze samples fed to them by a nationwide network of biologists as die-offs crop up. “It’s not like they’re happening all over, all the time,” Richard said. “It’s not reasonable to have people at the ready in every state.”

In 2016, when Richard was just settling into his first post-grad job as a Fish and Wildlife Service biologist in the Southeast, the Strike Force had yet to assemble. But soon it would have a reason to form. Within days of Richard’s start date, he got word mussels were dying in droves along the Clinch River in Virginia, nicknamed the “Appalachian Amazon” for its freshwater biodiversity.

Unlike Big Darby’s one-time catastrophe, Clinch’s mass mussel deaths would repeat themselves year after year — which means the first five years of Richard’s career have felt like a race against the next year’s die-off. “I’ve been spending the majority of my time and energy and life figuring out what’s going on,” he said. “You don’t get used to it. It sucks every time you see it.”

The following fall, and each one since, Richard and his colleagues fell into a routine. They’d collect hundreds of mussel samples and scramble to get them onto a cargo plane that leaves at 8 p.m. Sharp for an overnight flight

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from Tennessee to Wisconsin. At the other end, veterinary epidemiologist Tony Goldberg and the newly formed Strike Force waited.

While fungal, bacterial, and viral diseases have been documented for other aquatic invertebrates such as crayfish, oysters, and sea stars, potential freshwater mussel pathogens have only become a recent focus of scientific investigation. Goldberg, who has studied infectious disease in polar bears, primates, and penguins, suspects mussels could be suffering from their own version of the white-nose syndrome threatening North American bat populations or the Tasmanian devil facial tumor disease first observed in the 1990s.

In 2019, members of the Strike Force compared healthy Wisconsin mussels from the upper Mississippi to dead pheasantshells from the Clinch River. Using pliers and child-sized nasal speculums, they pried open the shells and withdrew a few drops of a bloodlike fluid called hemolymph, which furnishes about half the mussel's tissue weight and is circulated by a two-chambered heart wrapped around the anus. After incubating the samples, the scientists discovered 42 percent of the pheasantshells contained the bacterium *Yokenella regensburgei*, a very rare and poorly understood pathogen found in humans as well, and the same pathogen a separate team also documented in mussels during the peak of a recurring Alabama die-off. When the Strike Force analyzed samples from the Clinch River a few months after the die-off, the *Y. Regensburgei* strains had disappeared.

This is not the only research effort to point to bacteria in mussels sampled from a Clinch die-off. In an independent study of pheasantshells collected during in 2016, Virginia biologists noted an unidentified *streptococci*-like bacteria in one specimen. And the team discovered parasites had infested nine of the 10 samples and found lesions in the mussels' gills, digestive glands, and kidneys.

The mussels may be suffering from other germs, too. Last year, Goldberg and his colleagues reported the first known virus found in wild North American freshwater mussels, which they discovered by examining Wabash pigtoes from the Upper Mississippi River basin. They've also found viral genetic material in samples taken from a die-off site on the Chehalis River in Washington. (Prior to Goldberg's discovery, scientists had only documented one freshwater mussel virus: the Lea plague virus that has infected triangle shell mussels cultivated at high density for freshwater pearl production in China.) And there may be more. "We're in the middle of this," Goldberg said. "But I can assure you we're finding many, many undescribed viruses in freshwater mussels."

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Still, the Strike Force's various projects have yet to point to a clear culprit, Goldberg said. What they have done is implicate several possible suspects. "Our task is to figure out which one of those matters," he added. The overall strategy, Richard said, is to take advantage of the Clinch's recurring events to answer questions raised by it and the other die-offs scattered from Oregon to Europe. "It's such a black box," he said. "But if there's ever a place where we're going to find an answer, it's Clinch."

Although the covid-19 pandemic has put many scientific field research projects in limbo, the Strike Force hopes to focus its attention this year on mussel deaths in Europe — Sweden in particular — and the Pacific Northwest, where at least 16 die-offs or suspected die-offs have been documented in since 1984.

As part of that effort, biologist Emilie Blevins will drive this summer to six spots along the Chehalis River, a 115-mile scythe-shaped river located about halfway between Seattle and Portland, to gather samples. Blevins, who works for the invertebrate-focused conservation group Xerces Society, will don a snorkel mask and a wetsuit — or even better, she hopes, a dry suit, so she can wear a fleece onesie underneath. Then, she will fix her gaze past the creek's many flitting aquatic inhabitants, toward the bottom, and seek mussels, which at first glance resemble small stones. Even though they can be partially covered in sand or silt, Blevins said of the mussels, "once you get the eye for it, they pop out at you."

But before any of that happens, she has to take the first, worst step of surveying: approaching the site without knowing whether the mussels will be alive, dying, or dead. "You can show up too late," Blevins said. "You can't anticipate it. It's disturbing. I've had a nightmare of dead mussels." A graduate student once recorded 739 live mussels at a single site in the Chehalis; when volunteers surveyed the spot in 2018, they found 69. Further south, The Xerces Society has also collected samples from the Crooked River in Oregon, where about 4,000 mussels are estimated to have died in the last 15 years. When researchers examined western pearlshell mussels in Upper Bear Creek in Washington in 2007, about 100 miles from the Chehalis, they found an apparently stable population had crashed over the course of a decade, and noted empty shells dominated once-healthy sites. "It's not this slow disappearance of mussels," Blevins said.

Bottom of Form

How many mussels Blevins is able to spot along the bottom of the Chehalis this summer will help determine whether the Pacific Northwest's

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populations are still crashing. And she hopes the samples will offer up clues for the Strike Force. Last year, for example, the Wisconsin lab found an unidentifiable virus in tissue and hemolymph taken from the Chehalis mussels. "It's a riddle that everyone wants to solve," Blevins said.

That's just one of many leads the Strike Force plans to follow this year. It will continue to investigate mussel microbiomes to understand which internal bacteria and parasites are normal, and which might not be. The team will continue to isolate and investigate viruses. Richard will also "dig past in time," he said, and work through a stockpile of hundreds of samples preserved in a giant freezer in the lab's basement. And plans are in motion to set up a biosecure facility this summer where they can run experimental trials and test the effects of possible culprits in a controlled setting. "There's not really one way to handle this," Richard said. "We're putting our heads together."

The collaboration met in March — just before widespread coronavirus lockdowns went into effect — to establish the framework for a master database of what they've collected so far to see if a broader picture emerges.

"I don't know that we're going to find a smoking gun," said Diane Waller, a U.S. Geological Survey biologist based in La Crosse, Wisconsin, who coordinates the Strike Force. "There are a lot of things we have to tie together and we're thick in the middle of it. But I am hopeful."

[undark.org](https://www.undark.org), 13 April 2020

<https://www.undark.org>

In Sumatra, an indigenous plea to stop a coal road carving up a forest

2020-04-08

JAMBI, Indonesia — "If the forest is gone, where else can we live?"

Teguh Santika is an indigenous woman from the Batin Sembilan community. Her home is in the Harapan forest in central Sumatra, one of the last remaining spans of lowland tropical rainforest left on the island, and a refuge for some of the most endangered creatures on Earth, including the Sumatran tiger.

But the forest is under threat. It's being eaten away at the fringes by oil palm farms and thinned out by illegal logging. But perhaps the biggest threat is a road being proposed by a coal company, PT Marga Bara Jaya

A third of the 88-kilometer (55-mile) road would slice through the forest.

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(MBJ), to truck coal from its mining site in South Sumatra province's Musi Rawas district to power plants in Musi Banyuasin district. A third of the 88-kilometer (55-mile) road would slice through the forest.

Local authorities support the plan, making it increasingly likely that it will be approved by the Ministry of Environment and Forestry. The ministry reportedly discussed the project's environmental impact assessment in November 2018 and February 2019.

For Teguh, the road will make it easier for illegal loggers, farmers, poachers and others to encroach deeper into the forest.

"Obviously it will bring profit to the state, but think also about the little people who live in this forest," she says. "Even without a big road, people have been encroaching in like ants."

The Harapan forest stretches 769 square kilometers (300 square miles) across the provinces of South Sumatra and Jambi. It was previously a logging concession, before being designated in 2008 as Indonesia's first ecosystem restoration concession (ERC). These are former concessions that private companies can license for restoration. The goal is to prevent these degraded areas from being permanently converted to oil palm plantations or smallholder farmland, by restoring them to their previous forested state.

Since then, the restoration has come a long way, thanks to funding from the Danish government and a management approach that involves the indigenous communities in patrols and conservation efforts. But the problems of encroachment into the area for hunting, logging and oil palm cultivation have persisted. And at the end of 2018, the Danish government ceased its funding, raising concerns about how much longer the Harapan forest can hold out against the onslaught of illegal logging and farming.

That same year, 120 hectares (300 acres) of the forest was cleared for oil palm farms, amid a reported plan by plantation company PT Perkebunan Sriwijaya to raze a total of 12,360 hectares (30,540 acres) for oil palms.

Teguh says she believes the forest can still be restored. But that depends on the road not being built, which would exacerbate the encroachment problem.

"We can restore this forest — as long as the encroachers are gone," she says.

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MBJ wasn't the first company to try to build a road here. In 2013, PT Musi Mitra Jaya, an obscure Indonesian company, proposed a similar project, but was turned down by the forestry ministry.

Teguh, an elder in her community, says she hopes this new proposal is also rejected by the environment ministry.

"I went to Jakarta to complain — to a minister or a presidential staffer, I'm not sure — but please," she says, "don't give an approval for this coal road."

[news.mongabay.com](https://www.news.mongabay.com), 8 April 2020

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

Fever can help the immune system, so what should we do if we have one?

2020-04-08

As news about coronavirus spread around the world, paracetamol soon began to disappear from shop shelves as people stocked up at home. In some places, the price of the drug shot up. That probably comes as little surprise given that one of the key symptoms of the infection is a fever.

We tend to routinely use drugs such as paracetamol or ibuprofen to try to bring down a high temperature, believing fever to be, at best, a passive and unwelcome bystander to infection and, at worst, a direct contributor to our illness. Yet mounting evidence suggests that fever may, in fact, be a strategy the body uses to ramp up its defences. This new understanding of what is going on when we are burning up could help us come up with better approaches to fighting infection altogether.

Normal body temperature is generally thought of as 37°C, although anything between 36.5°C and 37.5°C is considered normal (see "Highs and lows", overleaf). However, once your temperature hits 38°C, you have officially got a fever.

The most common cause of this is infection. "When immune cells recognise the telltale signs of a germ in the body – and often this can be quite early on in an infection – they release secretions which act on a brain area called the hypothalamus," says Daniel Davis, an immunologist at the University of Manchester, UK, and author of The Beautiful Cure: Harnessing your body's natural defences. The hypothalamus is responsible, among other things, for controlling body temperature, and it responds to these signals by releasing hormones that cause various heat-boosting responses. Blood vessels in our skin constrict so less heat is lost at the body's surface.

Yet mounting evidence suggests that fever may, in fact, be a strategy the body uses to ramp up its defences.

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Fat cells start burning energy and our muscles rapidly contract, causing shivering – both of which warm us up. As a result, the body's temperature starts to rise.

If it rises too far, that can be fatal. Our cells begin to die, releasing proteins into the blood that can damage the kidneys and other organs, resulting in their failure. The exact temperature this happens at probably depends on the source of a person's fever, as well as other factors such as how hydrated they are. "The number 40 [degrees] scares a lot of doctors," says Mark Peters at the UCL Great Ormond Street Institute of Child Health in London.

Even so, many hospital doctors will routinely give fever-reducing drugs as soon as a patient's temperature hits 38°C. Even a mild fever comes at a great cost: raising your body temperature by just 1°C requires a 10 per cent increase in energy expenditure. Fever is associated with a higher pulse and breathing rate, placing additional strain on the heart and lungs that could be risky in seriously ill people.

So if fever can kill us, why does it happen? Fever-like responses are observed in many organisms, suggesting fever's evolutionary origins may stretch back hundreds of millions of years. Even some plants have been shown to increase their leaf temperature in response to fungal infections, while cold-blooded creatures will deliberately raise their body temperature if they have an infection, by sitting on a hot rock, for instance. In the case of the desert iguana, not being allowed to do so was seen to cause a 75 per cent reduction in survival rates.

That suggests fever might not be all bad. "Things that have a very high metabolic cost would not be preserved throughout evolutionary history unless they came with a clear survival advantage," says Peters.

The idea that fever might actually have medical benefits goes way back. The ancient Greek physician Hippocrates claimed that "those who cannot be cured by [medicine or] surgery can be cured by heat; and those who cannot be cured by heat are to be considered incurable". In 1927, the Nobel prize for medicine was awarded to the Austrian physician Julius Wagner-Jauregg for his discovery that triggering a high and persistent fever by inoculating people with malaria could treat their syphilis; the malaria was later treated with quinine.

[Fever reliever](#)

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Modern medicine has moved on considerably, and so has the way we think about fever. It is easy to see it as the thing that is making us ill, not a symptom along with other things like a runny nose or sore throat. "People often equate fever with the cause of the fever – even many doctors struggle to get their heads around that separation of fever being the response to a problem, and not necessarily the problem itself," says Peters.

Fever can also feel unpleasant, and many of us feel glad when our temperature drops after taking some medication. From all these perspectives, it makes sense to want to bring temperatures down as quickly as possible. That's certainly how the medical profession views things, says Peters. "Correcting fever has become a routine part of intensive-care practice, almost to the point where it's not discussed."

But there are hints we might be missing something. Take the common viral infection chickenpox. In a study of 72 children, those who weren't given drugs known to reduce fever recovered faster. Likewise, a study of 56 people infected with one of the viruses that causes the common cold found that those who took certain fever-reducing drugs remained infectious for longer.

Similarly, people who are admitted to intensive care units with infections and a slightly raised temperature tend to fare better than those who have a normal temperature, or one higher than 40°C. One reason for this may be that bacteria and viruses find it easier to replicate and infect cells at temperatures below 37°C. "By increasing your body temperature, you may be slowing down the ability of a virus to multiply," says Davis.

"By increasing your body temperature, you may be slowing the ability of a virus to multiply"

It also seems that the immune system works more efficiently when the body gets hotter. Immune cells that act as first responders to infection, such as dendritic cells, macrophages and neutrophils, have been shown to arrive at the scene faster, and have an improved capacity to engulf and destroy infectious agents at 38°C to 40°C. Fever also seems to make these cells better at recruiting and activating T-cells, which coordinate longer-term "adaptive" immune responses, such as antibody production. And T-cells and antibody-producing B-cells also better respond to instructions from the immune system at these temperatures.

Recent studies are providing new insights into how this happens. One published last year suggested that running a temperature of 40°C may

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help T-cells crawl out of the blood towards sites of infection, by producing proteins that allow them to anchor to the blood vessel wall.

Raising body temperature by just a few degrees also speeds up a cellular "clock" that controls the switching on of a set of inflammation-promoting genes, according to recent work by Mike White at the University of Manchester and his colleagues. "You see a dramatic change in the timing of this system, where pretty much every degree makes a difference," he says.

This is unusual in biological systems: even the circadian clock, which generates roughly 24-hour rhythms in our physiology, is insensitive to temperature. That implies fever may be a deliberate strategy to bolster our immune defences in the face of infection. "It suggests that the immediate immune response is that bit faster at higher temperatures," says White, which may explain the speedier resolution of some illnesses.

All of this raises the question of when – and how – fever should be treated. Peters recently conducted a trial in 100 children who were critically ill with suspected infections. He wanted to explore whether it was feasible to let their temperatures rise as high as 39.5°C before administering fever-reducing drugs, instead of 38°C, which is the current practice in most UK hospitals. The children continued to receive other treatment. The trial showed that there were no adverse outcomes from treating at higher temperatures, but it wasn't designed to test if this resulted in faster recovery.

Meanwhile, a recent meta-analysis combined the results of various trials assessing the impact of treating mild fever in hospitalised adults. It concluded that there was no difference in survival between those who received more active management of their fever and those who received less. So far then, the results suggest there isn't a lot in it, although it is still early days.

It might be that we are focusing on the wrong problem, however. The question isn't whether we should treat fever, but in which patients we should do it, says Edward Walter, an intensive care doctor at Royal Surrey County Hospital in Guildford, UK, who recently reviewed the medical literature on fever. Rather than seeing it as a single thing, he says that running a high temperature can be a response to various problems. In addition to infection, these include brain injury, heatstroke and taking certain drugs such as ecstasy, so our response to it might need to be more nuanced, he says.

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Another good question to ask is whether we have the means to treat the underlying cause of the fever. "If you're going to get an advantage from fever, it will probably be in populations where you cannot easily achieve control of the infection by existing means," says Peters. With pneumonia triggered by a bacterial infection, for instance, antibiotics will often treat the pneumonia, in which case there may be limited benefit to letting a fever run.

However, we currently have no effective drugs for pneumonia triggered by the new coronavirus, and so Peters speculates that mild fever could be helpful in such a situation.

Not everyone agrees. "You cannot really say fever is good, period, or fever is bad, period," says Andrej Romanovsky at the University of Arizona, who edits the journal *Temperature*. "The only practical way to answer how we should treat fever is to run clinical trials in specific populations suffering from a specific disease and using specific [fever-reducing] drugs."

In the case of covid-19, such trials may be years away. In the meantime, the UK's National Institute for Health and Care Excellence (NICE) is reviewing evidence on ibuprofen to try to clarify whether it is safe for treating the symptoms of covid-19 infections, after French health officials controversially urged people with symptoms to avoid the drug. The current advice from the World Health Organization is that either paracetamol or ibuprofen can be used to treat symptoms of the illness. In the UK, the advice from the National Health Service is to take paracetamol – although it doesn't say whether that is for fever or for other symptoms such as a sore throat.

"Fever is probably helpful in a very limited way, in those situations where we have light infections, but we should also consider how a person is sleeping and how they feel," says Romanovsky. "For mild cases, it probably doesn't matter whether you take a drug to take the fever down."

And most health services advise that a mild fever of up to 38.9°C, in the absence of more worrying symptoms, will probably get better with rest and fluids. So if your fever is mild, and you aren't in great discomfort, you might want to remember what is going on inside. "Permitting a fever in the viral condition is likely to allow your immune system to do its job – as it has been designed by millions of years of evolution – better," says Peters.

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This article is not medical advice. Very high temperatures can be dangerous. If you are feeling unwell, seek the advice of your doctor, especially if your fever is accompanied by other symptoms.

newsscientist.com, 8 April 2020

<https://www.newsscientist.com>

We may have spotted a parallel universe going backwards in time

2020-04-08

IN THE Antarctic, things happen at a glacial pace. Just ask Peter Gorham. For a month at a time, he and his colleagues would watch a giant balloon carrying a collection of antennas float high above the ice, scanning over a million square kilometres of the frozen landscape for evidence of high-energy particles arriving from space.

When the experiment returned to the ground after its first flight, it had nothing to show for itself, bar the odd flash of background noise. It was the same story after the second flight more than a year later.

While the balloon was in the sky for the third time, the researchers decided to go over the past data again, particularly those signals dismissed as noise. It was lucky they did. Examined more carefully, one signal seemed to be the signature of a high-energy particle. But it wasn't what they were looking for. Moreover, it seemed impossible. Rather than bearing down from above, this particle was exploding out of the ground.

That strange finding was made in 2016. Since then, all sorts of suggestions rooted in known physics have been put forward to account for the perplexing signal, and all have been ruled out. What's left is shocking in its implications. Explaining this signal requires the existence of a topsy-turvy universe created in the same big bang as our own and existing in parallel with it. In this mirror world, positive is negative, left is right and time runs backwards. It is perhaps the most mind-melting idea ever to have emerged from the Antarctic ice – but it might just be true.

The ambitions of the balloon experiment, the Antarctic Impulsive Transient Antenna (ANITA), were never so grand. Earth is constantly bombarded by particles known as cosmic rays that come from the furthest reaches of space, some of which have a million times more energy than we can generate with our best particle accelerators. Cosmologists are curious to know what these ultra-high-energy cosmic rays are made of and where

Rather than bearing down from above, this particle was exploding out of the ground.

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they come from, but these questions are difficult to answer. For one thing, the trajectories of the rays are distorted by our galaxy's magnetic fields, making their point of origin almost impossible to trace.

"No known physics can account for the perplexing signal"

Luckily, whatever does generate ultra-high-energy cosmic rays almost certainly generates a more useful beacon: neutrinos. Owing to their lack of charge, these tiny particles are unswayed by magnetic fields, and zip through space in straight lines. As a consequence, locating the origin of a neutrino – and that of any cosmic rays generated in tandem – is simply a matter of extrapolating its trajectory backwards from its point of impact. And that is where ANITA comes in.

When a high-energy neutrino plunges into the Antarctic ice, it creates a shower of charged particles that generate radio waves. If ANITA detects these radio waves emanating from the surface, its researchers can figure out where the neutrino struck, and work out the origin of the accompanying cosmic rays. "There's nothing unknown about the process," says Gorham, an experimental particle physicist at the University of Hawaii and principal investigator at ANITA.

Yet it couldn't explain what the researchers identified in 2016. Instead of crashing into the ice from overhead, the high-energy particle they were dealing with seemed to have erupted from the ground, presumably having entered Earth on the other side. Normal, low-energy neutrinos can make such a journey, because they pass through matter with ease. But high-energy neutrinos hit an object as solid as a planet in something akin to a particle belly-flop: they simply can't pass through it unhindered. Neither can cosmic rays.

The next idea was to try some creative workarounds. Neutrinos come in three known types: electron, muon and tau. None of these can traverse matter at high speed, but the tau neutrino can very occasionally transform into another particle known as a tau lepton, before reverting to a tau neutrino. It was just possible that a high-energy tau neutrino survived the transit through Earth by performing this type of shape-shift on entry. But it was a contrived idea, and the ANITA scientists knew it. "Not everyone was comfortable with the hypothesis," says Gorham.

The whole puzzle only got worse in 2018, when ANITA spotted another apparent signal of a massive particle erupting from the ground. An independent analysis by Derek Fox and others at Pennsylvania State University showed how unlikely spotting two events of this type ought to

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have been. According to their calculations, the chances of a tau neutrino getting a free pass through Earth during an ANITA flight twice was one in a million. "Now we're out of easy explanations," says Gorham.

The harder ones take us beyond physics as we know it. For more than 40 years, particle physics has been governed by the standard model, a set list of particles and forces that has proven remarkably accurate at explaining the natural world. But in times like these, researchers are often tempted to go off menu. Ivan Esteban at the University of Barcelona in Spain, for example, has suggested that the culprit could be the axion, a hypothetical particle predicted in the late 1970s to redress an imbalance in one of the four fundamental forces of nature. He believes the radio signals could be caused by axions turning into photons as they interact with Earth's magnetic field.

Meanwhile, Fox and his colleagues have turned to supersymmetry, a hefty extension to the standard model in which every known elementary particle has a twin that is typically more massive. They believe a supersymmetric tau, or "stau", stands much better odds of making the journey through Earth and generating the ANITA signal. The trouble is, other experiments designed to detect supersymmetric particles, such as the Large Hadron Collider at CERN near Geneva, Switzerland, have resolutely failed to do so. That has led many physicists to look askance at predictions that depend on supersymmetry.

"CPT symmetry has never been broken. But it spells trouble for the universe"

For Neil Turok at the Perimeter Institute for Theoretical Physics in Waterloo, Canada, all such proposals are needlessly complicated. Rather than inventing hordes of new particles to explain mysterious phenomena, he believes we should work with what we know already. "Particle physics has gone from being the most economical predictive theory we know, to the least, and an amazing number of people have accepted that," he says. "Well, I haven't."

Turok's passion for keeping things simple might have led him to a remarkable solution to the problem of the ANITA signals. Initially, he was concerned with a field very remote from the Antarctic ice: the immediate aftermath of the big bang. One of the few guides to help study this period is the notion of symmetry, the idea that physical laws remain the same under certain transformations.

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We refer to these symmetries by shorthand. C, for example, is short for charge conjugation symmetry, which holds that flipping the charge of a particle – replacing it with its antimatter equivalent, in other words – has no effect on its essential behaviour. P stands for parity transformation symmetry, under which the physics in one scenario is indistinguishable from that in its mirror image. T represents time reversal symmetry, which means that a process played backwards in time doesn't violate any physical laws.

One or two processes involving fundamental particles are known to violate the C, P and T symmetries individually. In all such cases, however, the other two symmetries are also violated to compensate, so that, taken as a whole, CPT symmetry is never broken. "No one has ever found a way to avoid it," says Turok. "It's a very deep statement about nature."

In 2018, Turok and his Perimeter Institute collaborators, Latham Boyle and Kieran Finn, set out to discover what CPT symmetry would mean if it also held in our universe's earliest moments. They found that their resultant calculations placed strict limits on the types and numbers of particles spewed out in the big bang. One of these was a heavy "right-handed" neutrino. This is, contrary to Turok's guiding philosophy, a hypothetical particle, but one that is widely believed necessary to counterbalance the mass of the neutrinos we already know about, which are called left-handed because of the way they spin. With its abundance fixed by CPT symmetry, Turok and his colleagues found that if they tuned its mass just right, it matched the photofit of one of the universe's most elusive substances – dark matter, the universe's missing mass that physicists have been seeking for decades. "We couldn't believe it," says Turok. "The right-handed neutrino just dropped out as a dark matter candidate."

Dark matter candidates aren't hard to come by. This one, however, had a mass of 500 million billion electronvolts, or about one million-billionth of a gram. What Turok didn't know at the time was that this was dead in line with the mass of the particle ANITA had seen.

Fearful symmetry

Theorist Luis Anchordoqui at the City University of New York in the US and his colleagues were the first to point out the coincidence. They suggested that, over millions of years, right-handed neutrinos pervading the cosmos have been scooped up by Earth's gravity, nestling in the planet's interior ever since. And they also predicted that these dark matter particles occasionally decay into Higgs boson and tau neutrino pairs, thereby creating the ANITA signals. "The ANITA energy is exactly the one

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these guys are predicting," says Anchordoqui. "That's the amazing thing." It is a specific, quantitative prediction, and it is backed up by experiment, a rare thing in particle physics right now.

But if the premise underlying the idea is true, that spells trouble for the universe as we know it. One consequence of CPT symmetry holding in the very first moments after the big bang is that our cosmos would have contained equal quantities of matter and antimatter. Infamously, these two don't get along, and would have promptly annihilated one another, leaving only energy behind. The fact that matter vastly outnumbers antimatter today leads many cosmologists to think that CPT symmetry wasn't always as rigidly adhered to as it is today. By doubling down on its infallibility, Turok and his colleagues were left with a major question: how does our universe even exist?

As it turns out, the answer lies in CPT symmetry itself – and it is mind-blowing. To understand it, consider one of the most basic particle processes we know of: the creation of an electron and its antimatter counterpart, a positron, in the presence of a strong electric field. In strict adherence to CPT symmetry, however, there is another way of viewing this: the positron is an electron that travelled backwards in time until the moment of electric-field generation, and then turned around to go forwards in time. Weird as it sounds, the two descriptions are entirely equivalent, and there is no way to find out which is "real".

Turok's extraordinary prediction is that something similar happened to our universe. The conventional view of the big bang is that it was the moment of creation for a single cosmos that is almost completely devoid of antimatter. But for CPT symmetry to be conserved, then the big bang would have had to create two parallel universes, with most of the matter funnelled into one – ours – and most of the antimatter ending up in the other. In the other universe, everything would be upside-down and back to front, and any stars or planets it might contain would be made of antimatter rather than matter. Even more astonishingly, this anti-universe would be contracting backwards in time towards the big bang, rather than expanding away from it.

Turned on its head

At least, that is what it would look like from our point of view. Just as CPT symmetry dictates that a positron travelling forwards in time is equivalent to an electron travelling backwards in time, so too is our impression of the anti-universe relative. To inhabitants of the anti-universe, it is our universe that is upside down, shrinking towards the big bang and filled with the

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“wrong” sort of matter. We can’t know which universe we are in, only that the other universe is, relatively speaking, backwards. In cosmic terms, this means that time isn’t an arrow imposed by some external observer. It is more like a personal weathervane, pointing in whichever direction it is that our universe expands.

This is a radical departure from the existing view of cosmology, and Turok is the first to admit that there are one or two loose ends. But he believes he and others will be able to resolve the remaining difficulties without the need for any new particles. “If we can, there will be no contest anymore: our theory will be infinitely better than anything else,” he says.

Yet there is potentially a spanner in the works. If ANITA has indeed caught the right-handed neutrino that the anti-universe idea predicts, common sense dictates that other neutrino observatories ought to have caught it, too. Towards the end of last year, the neighbouring IceCube experiment – which continuously watches for flashes of light generated as the decay-products of neutrinos blast through a cubic kilometre of Antarctic ice – announced that it had found no high-energy neutrinos coming from the direction claimed by ANITA.

This isn’t a killer blow for the anti-universe. Anchordoqui points out that the track of a high-energy tau neutrino can be mistaken for that of a lower-energy muon neutrino, of which IceCube has spotted at least one. It is a controversial view, but it suggests that both ANITA and IceCube may have discovered tantalising evidence for a parallel universe.

“This anti-universe would be contracting backwards in time”

There are many other avenues for support, too. The anti-universe idea predicts that the big bang ought to have generated no primordial gravitational waves – ripples in space-time that many cosmologists are hunting but have failed to detect. And it predicts that the lightest of the three neutrinos is actually massless, a finding Turok believes could be confirmed in the next five to 10 years. It is by hard predictions such as these that the anti-universe idea will live or die. “We’ve tied our hands,” he says.

Meanwhile, the focus is returning to the Antarctic, and the possibility of capturing more massive particles as they explode from the ground. It has been three years since ANITA’s fourth flight descended softly to the ice, and an analysis of the latest data is still in the making.

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Gorham is reluctant to preview the contents. "We don't know how to represent it yet," he says. "But we've got something."

newscientist.com, 8 April 2020

<https://www.newscientist.com>

Developing a new solution for Nuclear Waste Disposal

2020-03-31

Two Carbolite Gero MTT furnaces specially designed for extracting carbon-14 and fixed tritium are being used by the Nuclear Graphite Research Group (NGRG) at the University of Manchester in a project to develop new nuclear waste disposal procedures.

Two Carbolite Gero MTT furnaces specially designed for extracting carbon-14 and fixed tritium are being used by the Nuclear Graphite Research Group (NGRG) at the University of Manchester in a project to develop new nuclear waste disposal procedures.

If the UK's current nuclear reactors operate to their proposed shutdown dates, approximately 100,000 tonnes of nuclear grade graphite will require disposal. This graphite would be considered as intermediate level waste (ILW). The current strategy for storing this material is long-term deep burial in a geological disposal facility (GDF) -- a costly and time-consuming procedure.

Each nuclear reactor typically contains at least 2000 tonnes of nuclear graphite in the form of large blocks. Reducing the volume of this material by gasification is the target of the research project at the NGRG. The Carbolite Gero furnaces are being used to determine, at laboratory scale, the optimum specifications for this procedure, including the dimensions of the material to be processed and the temperatures, time and oxygen concentrations required.

Cubes of nuclear-grade graphite are first size-reduced into particulate form before being placed into ceramic boats and heated in the furnaces. While at elevated temperatures, oxygen is passed through the furnace, leading to oxidation of the graphite and the production of CO and CO₂. These gaseous releases can then be monitored through mass spectroscopy

The current strategy for storing this material is long-term deep burial in a geological disposal facility (GDF) -- a costly and time-consuming procedure.

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The furnaces use catalyst-assisted combustion techniques to extract the carbon-14 and organically bound tritium cleanly and precisely and without contamination of scintillation media. A specially designed manifold optimises catalyst performance. Sample capacities up to 20ml provide accurate determinations in the 38mm-diameter quartz glass work-tube assemblies. The heated length of the furnaces is 850mm and maximum temperature 1200°C, with both heating zones in each unit having over-temperature protection.

Both Carbolite Gero units have a 20-segment programmable temperature controller for sample-specific combustion protocols, as well as sophisticated data storage and communications capabilities.

[environmental-expert.com](https://www.environmental-expert.com), 31 March 2020

<https://www.environmental-expert.com>

Airport CEO believes health tests for passengers will become more common

2020-04-08

An airport CEO in England revealed to local media outlets that infrared cameras currently being used to spot passengers who are potentially sick could become a new normal at the facilities.

London's Heathrow Airport CEO John Holland-Kaye, said several travel hubs around the world have already mandated the use of technology to take the temperatures of travelers passing through their facilities, **The Sun reported**.

Holland-Kaye said that once the coronavirus outbreak is under control and travel restrictions are lifted, airports may continue to use the technology to "provide reassurance and confidence in flying" for passengers.

"I can completely understand why passengers would wonder why they saw cameras at the airport where they got on the plane but didn't see them when they arrived," Holland-Kaye said.

A call for global collaboration on health testing has been called for when the aviation industry returns to full service, but admitted the infrared cameras might not be effective in diagnosing patients with coronavirus, It can take up to two weeks before they show symptoms.

"That was a big change in the way people travel. It helped keep people safe," Holland-Kaye said.

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Holland-Kaye also called on the industry to agree on new health testing regulations, including the implementation of further thermal cameras, which he compared to the bans put on liquids in 2006.

“That was a big change in the way people travel. It helped keep people safe,” Holland-Kaye said.

Etihad Airways announced on Monday they have agreed to a new partnership with Australia-based Elenium Automation to trial new self-service devices at airports used to identify travelers with medical conditions.

The airline said that the new technology, which can monitor the temperature, heart rate and respiratory rate of anyone using an airport touchpoint like a check-in kiosk, bag drop facility or a security gate, could potentially spot the early stages of coronavirus.

[securitytoday.com](https://www.securitytoday.com), 8 April 2020

<https://www.securitytoday.com>

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(NOTE: OPEN YOUR WEB BROWSER AND CLICK ON HEADING TO LINK TO SECTION)

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[Efficiency and mechanisms of simultaneous removal of *Microcystis aeruginosa* and microcystins by electrochemical technology using activated carbon fiber/nickel foam as cathode material.](#)

[Chrysin ameliorates hepatic steatosis induced by a diet deficient in methionine and choline by inducing the secretion of hepatocyte nuclear factor 4 \$\alpha\$ -dependent very low-density lipoprotein](#)

ENVIRONMENTAL RESEARCH

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[Protocol for a prospective, observational, longitudinal study in paediatric patients with moderate-to-severe atopic dermatitis \(PEDISTAD\): study objectives, design and methodology.](#)

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The association of silicosis severity with pectoralis major muscle and subcutaneous fat volumes, and the pulmonary artery/aorta ratio evaluated by CT.

Diesel Exhaust Exposure during Farming Activities: Statistical Modeling of Continuous Black Carbon Concentrations