

‘Gene drive’ ban back on table — worrying scientists

United Nations body will again discuss risks of divisive technology, which could fight diseases.

BY EWEN CALLAWAY

Government representatives from nearly 170 countries are considering whether to temporarily ban the release of organisms carrying gene drives — a controversial technology that can quickly propagate a chosen gene throughout a population. The technique has the potential to eradicate disease, control pests and alter entire ecosystems, but with unpredictable consequences — leading some groups to call for a global moratorium on its field applications.

Chances are slim of a ban being approved at this month’s meeting of the United Nations Convention on Biological Diversity (CBD), which began on 17 November in Sharm El-Sheikh, Egypt. That’s because such a decision must be agreed by consensus, and biotechnology-friendly countries are unlikely to agree to such restrictions. Even so, some scientists worry that the discussions could set the tone for future limits on the use of the technology.

In an open letter on 14 November, a group of more than 100 researchers — including many studying gene drives — urged governments to

reject the moratorium, echoing a statement issued by Britain’s Royal Society this month.

“An open-ended moratorium on gene drives, without defining what is meant by ‘gene drive’ — that’s awfully crude and completely wrong-headed,” says Austin Burt, an evolutionary geneticist at Imperial College London who plans to attend the CBD meeting. He leads the Target Malaria project, which hopes to use the technology to control the spread of malaria by mosquitoes in sub-Saharan Africa. “It would stifle research,” he adds, because funders might cut support.

But Jim Thomas, co-executive director of the ETC Group, a pressure organization in Ottawa, supports a moratorium on the technology while the CBD considers potential risks and benefits. “It takes the wind out of the hype that this is somehow a ready solution,” Thomas says.

Gene drives are genetic elements that ensure their inheritance by offspring, allowing even harmful gene variants to spread rapidly through a population. They occur naturally in flies, mice and other organisms. But the advent of gene-editing tools such as CRISPR–Cas9 in the past few years has helped scientists to

develop ‘engineered gene drives’ that could be applied to any sexually reproducing organism.

Organisms containing CRISPR-engineered gene drives have not been released into the wild, but their development has stoked fears that even well-meaning applications of the technology, such as attempts to reduce populations of organisms that spread disease, could have unintended consequences for ecosystems.

Burt’s team — which has received tens of millions of pounds from the Bill & Melinda Gates Foundation in Seattle, Washington — is working on gene drives in malaria-transmitting *Anopheles* mosquitoes, with the aim of reducing populations to stop disease spread. Researchers hope to target other pests with gene drives; one international collaboration wants to use them to control invasive rodents in island ecosystems.

Individual nations can regulate the release of gene drives. But the CBD, an international treaty established in 1992 and signed by 168 countries — with the notable exception of the United States — lays out principles for conservation and the sustainable use of biodiversity, and influences national laws. It already places limits on the release of living



Anopheles mosquitoes, which transmit malaria, are the centre of many gene-drive research efforts.

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genetically modified (GM) organisms.

In 2014, the CBD convened an expert panel of scientists and environmentalists, with the goal of determining whether synthetic biology poses challenges to the treaty. Over the past few years, gene drives have risen to the top of the group's list of issues to tackle, notes Thomas, who sits on the panel.

It's not the first time the CBD has considered a ban on gene drives. At a meeting two years ago, multiple organizations, including the ETC Group, unsuccessfully pushed for a moratorium on the technology.

LANGUAGE DEBATE

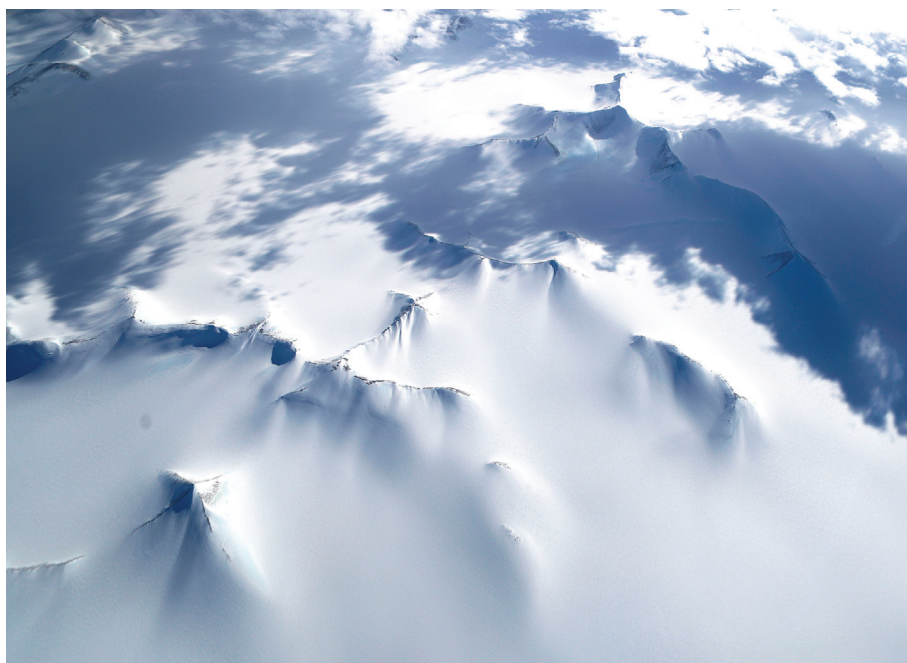
At the meeting, negotiators will again consider controversial language that calls on signatories to “refrain from the release, including experimental release, of organisms containing engineered gene drives”.

Although he supports a gene-drive moratorium, Thomas expects it to face steep opposition from some countries. Canada, Australia, New Zealand and Japan have all historically lobbied against limits on biotechnologies, he notes. Any addition to the treaty must be achieved by consensus.

Even if a gene drive moratorium is not approved, the language used is likely to frame how the CBD tackles gene drives in the future. A policy document prepared by the Outreach Network for Gene Drive Research, the group that organized the scientists' letter and which includes Target Malaria, says that countries will need to decide whether to take into account positive impacts of gene drives, and how to assess the environmental risk of any releases. Target Malaria hopes to start field trials as early as 2024.

One probable outcome of the meeting is an outline for future work on policy issues raised by organisms carrying gene drives, says Todd Kuiken, a biotechnology-policy specialist at North Carolina State University in Raleigh, who is also on the CBD's synthetic-biology panel. He says that key issues include determining whether existing guidelines for assessing risks from conventional GM organisms are suitable for those carrying gene drives, and working out how to ensure that local communities potentially affected by a gene drive are consulted first.

Because it is an existing treaty signed by most countries, the CBD is likely to remain the main forum for global discussion on the topic. But Natalie Kofler, founder of a coalition called Editing Nature formed to discuss the use of gene editing in the environment, questions whether the CBD is up to the challenge. “The conversation has become very polarized, and people are seeing it as this black-or-white issue. I think it demands so much more of us,” says Kofler, a molecular biologist at Yale University in New Haven, Connecticut. “I'm not sure if the CBD is providing structure to ensure a middle-ground conversation.” ■



Antarctic ice traps air bubbles from Earth's pre-industrial atmosphere.

ATMOSPHERIC SCIENCE

Hunt for the sky's 'detergent' begins

Ice-core team heads to Antarctica to measure past levels of chemical that scrubs atmosphere of greenhouse gases.

BY NICKY PHILLIPS

To understand how the sky cleanses itself, a team of Australian and US researchers is heading to Antarctica to track down the atmosphere's main detergent. By drilling deep into polar ice, the scientists hope to determine how the sky's capacity to scrub away some ozone-depleting chemicals and potent greenhouse gases has changed since the Industrial Revolution — information that could help to improve global-warming projections.

The first project-members travelled to Law Dome, their drilling site in East Antarctica, this week. There, they hope to capture the first historical data on concentrations of the dominant atmospheric detergent, the hydroxyl radical. This highly reactive molecule, made of an oxygen atom bonded to a hydrogen atom, breaks down about 40 gases in the air. They include methane and hydrofluorocarbons, but not the most prevalent greenhouse gas — carbon dioxide.

Researchers have used other atmospheric gases to infer the abundance of hydroxyl over the past four decades, but chemists still refer to the radical as ‘the great unknown’.

“We have been more or less in the dark when it comes to how hydroxyl has evolved from pre-industrial times to present day,” says Apostolos Voulgarakis, an environmental scientist at Imperial College London. “This new research endeavour can provide unprecedented information on hydroxyl variations in the deeper past, which is exciting.”

Over two and a half months, the team will drill at least two ice cores — three if time allows — to depths of about 230 metres. They will then melt the cores to extract bubbles of air that were trapped as the ice froze. The samples will represent the atmosphere back to about 1880, before emissions of greenhouse gases from human activity started to increase.

Hydroxyl radicals form naturally in the atmosphere in a reaction involving ultraviolet rays, ozone and water vapour. But because the radicals last about a second before they react with other gases and break them down, as a proxy, the team will instead measure the tiny fraction of carbon monoxide that contains the carbon-14 isotope.

Carbon-14 in carbon monoxide is produced in the atmosphere by cosmic rays at a known rate, and is almost entirely removed ▶