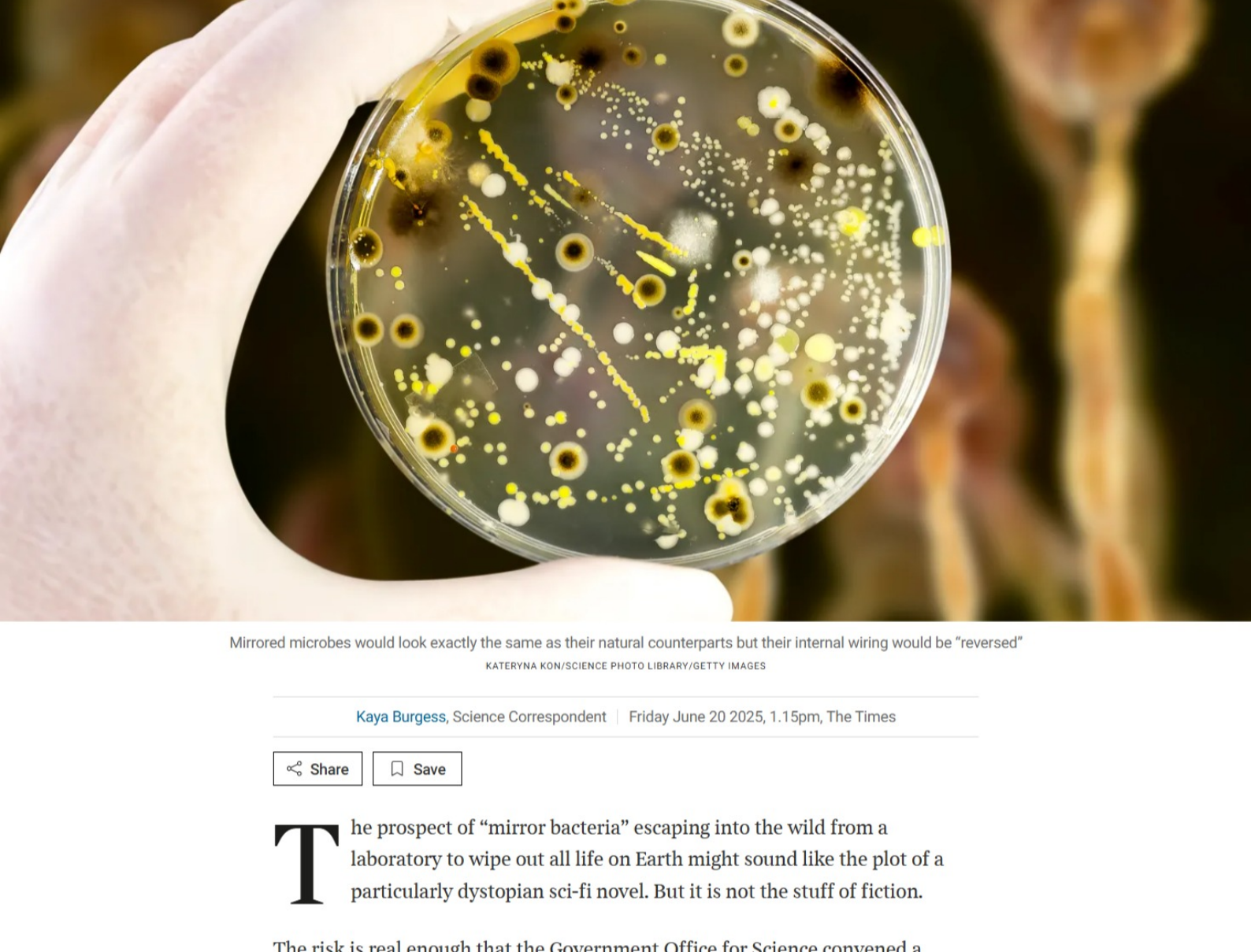


How a plague of ‘mirror bacteria’ could destroy all life on Earth

Creating microbes in the lab with ‘backwards’ molecules could lead to wonder drugs — or kill all living things on the planet. Is it worth the risk?



Mirrored microbes would look exactly the same as their natural counterparts but their internal wiring would be “reversed”
KATERVNA KON/SCIENCE PHOTO LIBRARY/GETTY IMAGES

Kaya Burgess, Science Correspondent | Friday June 20 2025, 1.15pm, The Times

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The prospect of “mirror bacteria” escaping into the wild from a laboratory to wipe out all life on Earth might sound like the plot of a particularly dystopian sci-fi novel. But it is not the stuff of fiction.

The risk is real enough that the Government Office for Science convened a meeting of experts chaired by Dame Angela McLean, the UK’s chief scientific adviser, to discuss the dangers of creating an unnatural new type of bacteria that could “threaten life on this planet as we know it” and even “act like cancer”, with potentially apocalyptic consequences.

The meeting was prompted by a [stark warning](#) sounded by a group of 38 distinguished scientists, including two Nobel laureates, who called on researchers to drop any plans to create synthetic “mirror” organisms immediately.



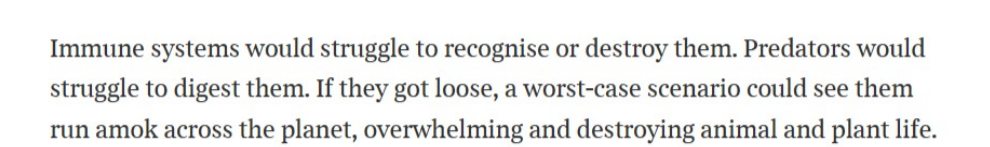
Dame Angela McLean, the UK’s chief scientific adviser, said safeguards needed to be put in place if research into mirror molecules were to continue
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They held a conference in Paris last week, with another to be held in Manchester in September, pushing for a rare global agreement that this particular avenue of scientific research should remain forever closed.

Through the looking glass

A mirror microbe would look almost identical to a normal one, except that its internal wiring — down to the arrangement of the atoms in their protein and DNA molecules — would be engineered in the laboratory to be backwards: a mirror image of how they exist in nature.

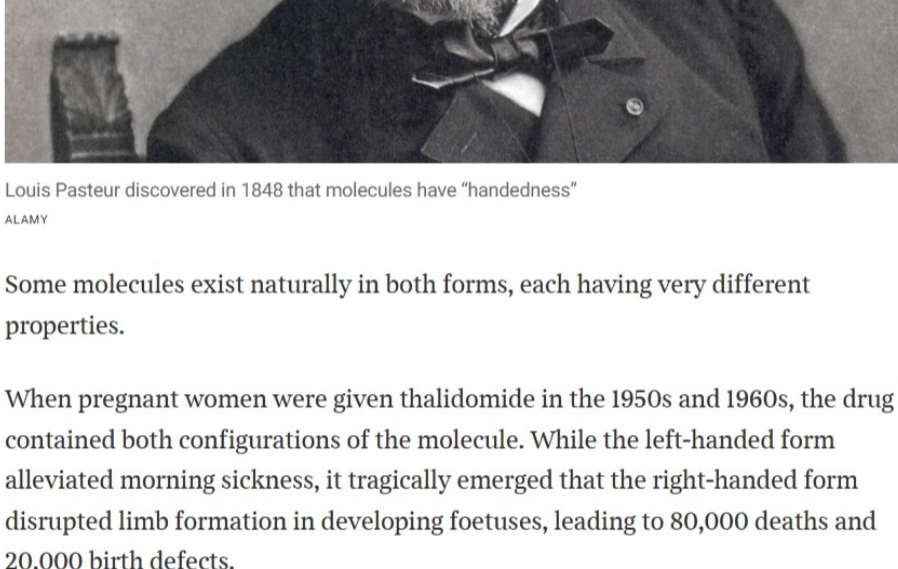
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Immune systems would struggle to recognise or destroy them. Predators would struggle to digest them. If they got loose, a worst-case scenario could see them run amok across the planet, overwhelming and destroying animal and plant life.

• [Creating ‘mirror bacteria’ could spark global catastrophe, scientists warn](#)

Louis Pasteur, the French chemist, discovered in 1848 that many molecules have a property called chirality, or “handedness”. They can exist in “left” or “right-handed” form depending on the arrangement of their atoms.

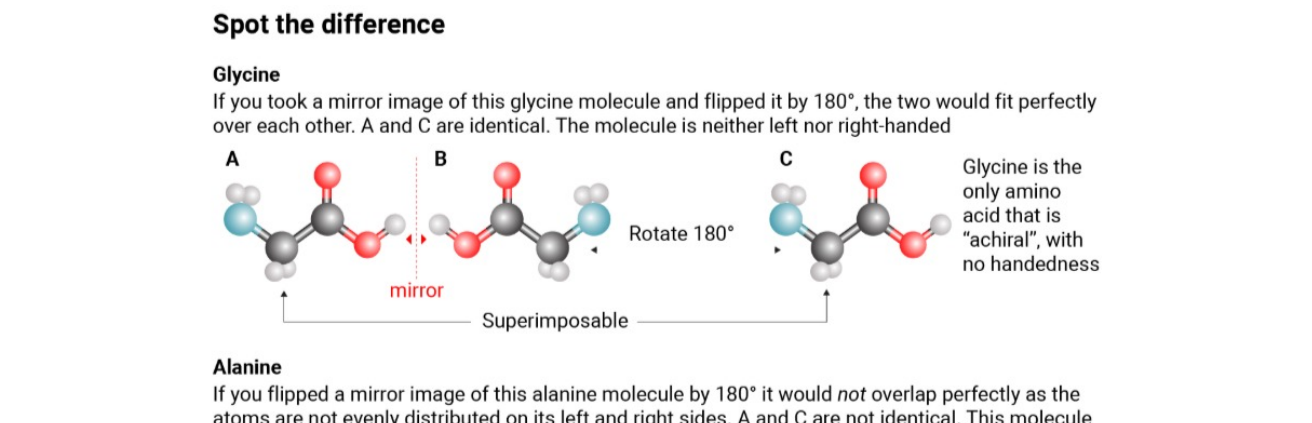


Louis Pasteur discovered in 1848 that molecules have “handedness”
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Some molecules exist naturally in both forms, each having very different properties.

When pregnant women were given thalidomide in the 1950s and 1960s, the drug contained both configurations of the molecule. While the left-handed form alleviated morning sickness, it tragically emerged that the right-handed form disrupted limb formation in developing foetuses, leading to 80,000 deaths and 20,000 birth defects.

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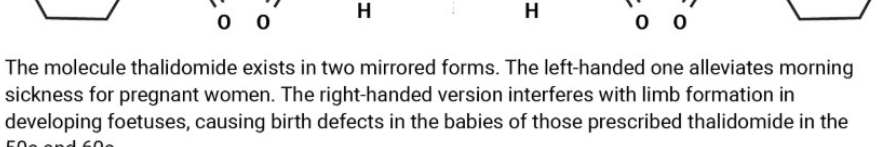


Some molecules come in only one form in nature. Almost all amino acids that make up proteins in living things are left-handed. The sugars in DNA are right-handed.

Spot the difference

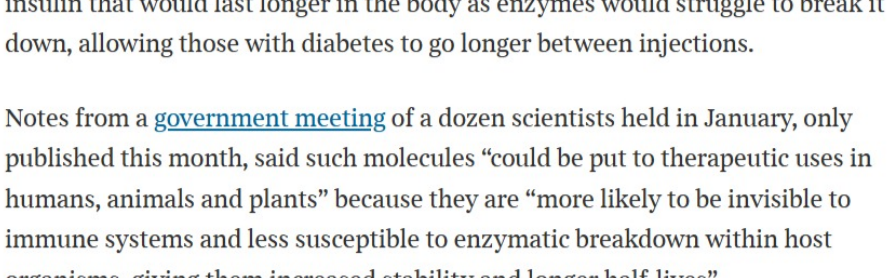
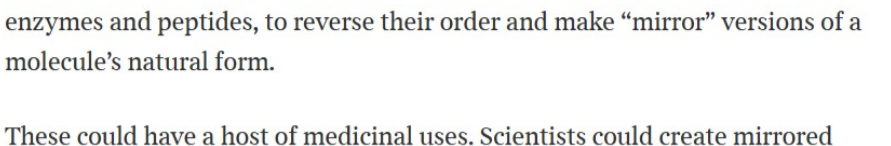
Glycine

If you took a mirror image of this glycine molecule and flipped it by 180°, the two would fit perfectly over each other. A and C are identical. The molecule is neither left nor right-handed



Alanine

If you flipped a mirror image of this alanine molecule by 180° it would not overlap perfectly as the atoms are not evenly distributed on its left and right sides. A and C are not identical. This molecule is left-handed in nature



The molecule thalidomide exists in two mirrored forms. The left-handed one alleviates morning sickness for pregnant women. The right-handed version interferes with limb formation in developing foetuses, causing birth defects in the babies of those prescribed thalidomide in the 50s and 60s

Graphic by The Times and Sunday Times

Why make mirrored molecules?

Chemists are learning to re-configure the bonds between atoms, such as within enzymes and peptides, to reverse their order and make “mirror” versions of a molecule’s natural form.

These could have a host of medicinal uses. Scientists could create mirrored insulin that would last longer in the body as enzymes would struggle to break it down, allowing those with diabetes to go longer between injections.

Notes from a [government meeting](#) of a dozen scientists held in January, only published this month, said such molecules “could be put to therapeutic uses in humans, animals and plants” because they are “more likely to be invisible to immune systems and less susceptible to enzymatic breakdown within host organisms, giving them increased stability and longer half-lives”.

From mirror molecules to mirror life

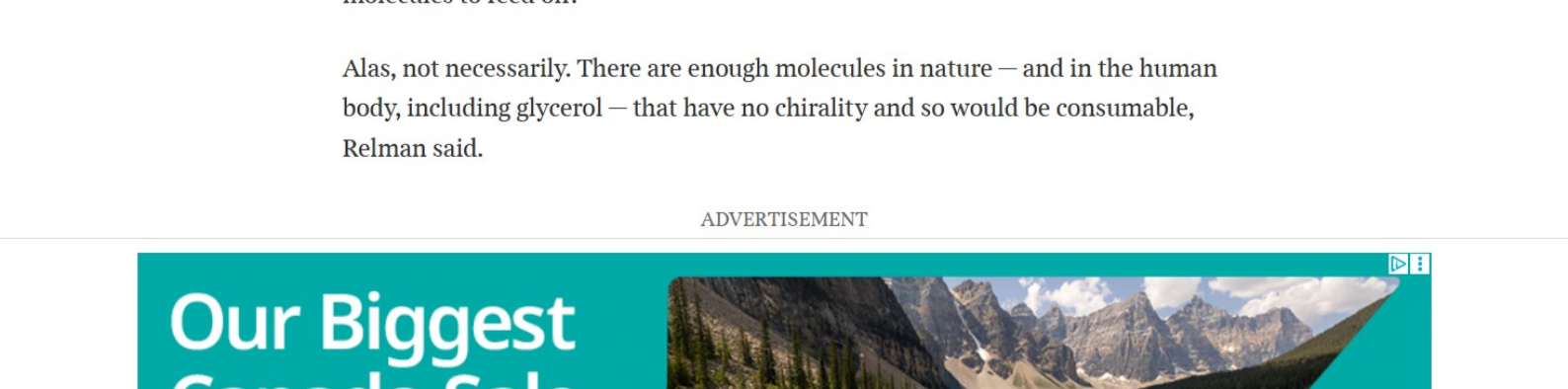
Creating mirror molecules in the lab is far from simple. But what if scientists could create a living organism whose entire internal machinery was arranged in mirror-image? This mirrored microbe could act like a microscopic factory, naturally churning out mirrored molecules.

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The prospect is “largely driven by scientific curiosity” rather than medical or economic need, the government meeting heard.

But the idea has sparked a rare terror among scientists. An antibody binds to an invading cell like a key fitting into a lock. If either were reconfigured in reverse, the key would no longer fit.



Bacteria such as E. coli are recognised by the human immune system but would not be in their mirrored form
KATERVNA KON/SCIENCE PHOTO LIBRARY/GETTY IMAGES

“It would be the ultimate invasive species,” said David Relman, a microbiologist at Stanford University. “It is possible that mirror life would basically invade and take over much of the ecosphere on the planet. When confronted by humans or animals or plants it would be largely impervious to our immune systems. We would likely die.”

Would mirror microbes not perish in the wild through a lack of mirrored molecules to feed on?

Alas, not necessarily. There are enough molecules in nature — and in the human body, including glycerol — that have no chirality and so would be consumable, Relman said.

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“There is almost no conceivable possible benefit [in making mirror life] that would come close to the magnitude of the risk,” he said. “We are literally talking about something which, if allowed to be pursued and developed, threatens life on this planet as we know it.”

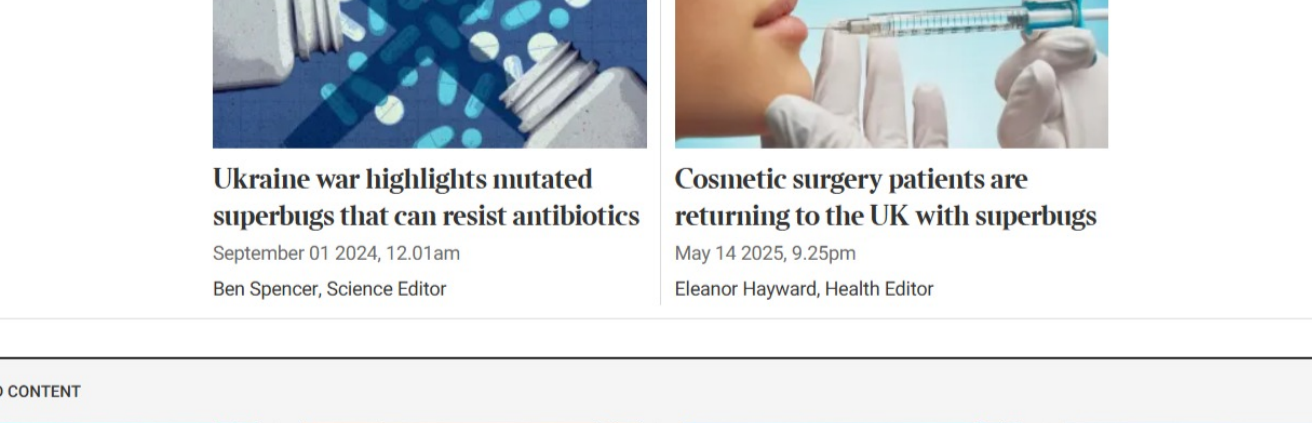
The government meeting noted: “There is also the potential for mirror bacteria to act like cancer: taking up oxygen, nutrients and physical space within a host ... Photosynthetic mirror life arguably poses the most significant threat, as this could sustain itself without an external food source.”

These organisms could “out-compete other life forms for resources, with implications for water, food supply, biodiversity and ecosystem stability”, it added.

Keeping Pandora’s box closed

Scientists are working to create synthetic cells built from scratch. It would not be a giant leap to adapt this to create mirrored life-forms within 10 to 30 years, Relman said.

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Filippa Lentzos, a professor of science and international security at King’s College London, addressed the meeting at the Pasteur Institute in Paris last week. Some scientists present had said it was their “long-term ambition” to create mirror life, “but they have reconsidered in light of the discussions about risks”, she said.

She compared it to fears among scientists when the feasibility of manipulating atomic energy to create nuclear bombs became clear in the 1930s.

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The governmental meeting concluded that “a clear distinction should be made” between creating inanimate mirror molecules and attempts to create living mirrored organisms.

“Beneficial scientific and technological advances for therapeutics and novel materials could cease if all mirror life research was entirely banned,” it said.

Patrick Cai, an expert in synthetic genomics at the University of Manchester, attended and said: “They don’t want to stop research into mirror molecules ... but I would argue we would not support activity to put them together into a bacteria that is self-replicating. That is the line we think we should draw in terms of regulation.”

McLean said mirrored molecules could “offer practical applications, spanning agriculture, medicine and manufacturing”, but said: “Appropriate safeguards are critical to ensuring a responsible approach to such innovation. The Government Office for Science has supported the government to identify opportunities and risks associated with mirror molecules.”

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