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Editorial

Plastic-Eating Microbes Won't Save Us from the Pollution Crisis

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Outside a bottle recycling plant in Sakai, Japan, in 2016, a group of researchers picking through the debris found a microbe doing something it had no business doing. The bacterium, later named *Ideonella sakaiensis*, was feeding on polyethylene terephthalate (PET), the plastic of water bottles and food trays, a material that had existed for barely seventy years. Evolution, it seemed, had already begun to answer a problem we had made. The bacterium carried two enzymes that worked in sequence, one cleaving the long polymer into shorter fragments, the other splitting those fragments into molecules small enough for the cell to absorb [1]. Here was a living thing that treated our most stubborn waste as a meal.

The discovery was remarkable, and the work that followed was better still. Within a few years, laboratories in Britain, France, and the United States had taken the bacterium's slow natural enzyme and sharpened it [2,3]. One redesign, built with the help of machine learning, broke down PET in days rather than the weeks nature required, and did so at temperatures mild enough to be practical [4]. Start-ups formed. Headlines promised a future in which plastic waste would be dissolved back into its building blocks and remade into new bottles, over and over, cleanly. The phrase "plastic-eating bacteria" became a kind of talisman, proof that human cleverness would dig us out of the hole we had spent a century digging.

The story is worth admiring before it is questioned. Consider what the work achieves, and where. The enzymes do their job in steel tanks, in volumes measured in litres, under conditions a technician sets and watches. The plastic problem is measured in something else entirely. The world now makes more than four hundred million tonnes of plastic every year, and has produced several billion tonnes in all, most of it still with us in one form or another [5]. To weigh a few tanks of enzyme against that is not a strategy. It is a rounding error offered as a plan. The chemistry narrows the promise further. The enzymes that work, work on PET, and PET is a minority of what we discard [5]. The great mass of plastic waste is polyethylene and polypropylene, the films, bags, and tubs built on a backbone of nothing but carbon bonded to carbon. Nature spent billions of years learning to take apart the molecules of living things, the sugars and proteins and tough fibres of wood, because there was always a meal in the breaking. It never had reason to learn this particular bond, because until lately the bond did not exist in any quantity. The few microbes that can gnaw at these polymers are rare and slow and so far useless at scale [6]. We are not waiting for them to be refined. We are waiting on evolution, or on chemistry we have not yet invented.

Grant, for a moment, that every one of these obstacles falls. Grant a fast and cheap enzyme for each kind of plastic. It would still reach only the waste we can gather and feed into a machine. The plastic that troubles us most is the plastic already loose: the fragments turning in the deep ocean, the threads laced through farm soil, the particles found in rainwater, in the flesh of fish, in human blood [7], in lung tissue [8], in the placenta [9]. You cannot pour bacteria into the sea. No tank is large enough, and a microbe set free to roam is a stranger and more alarming thing than one kept in a vat. The pollution that frightens us sits beyond any reactor's reach.

Even the word "degraded" deserves suspicion. When a polymer is broken down, whatever it carried is let loose. Plastics are not pure substances; they are laced with plasticisers, stabilisers, and dyes, a good many of them harmful, and partial breakdown can scatter these into the surroundings along with a haze of fragments smaller than the ones we began with [10]. A process sold as cleanup can quietly trade a visible problem for an invisible one, swapping the bottle on the beach for something we will be measuring in bloodstreams for decades.

The deepest trouble with the plastic-eating microbe is not technical at all. It is what the promise does to us. A cleanup forever about to arrive becomes a reason to go on making the mess, in just the way that the hope of pulling carbon back out of the air has become an argument for putting more of it there [11]. The story flatters the people with the most to lose from any real change. It recasts a crisis of production as a problem of disposal, and disposal as a chore the scientists will see to. Every breathless notice of a bacterium that eats plastic is, read the other way, a permission slip to make more of it. Ask who gains when a flood is described as a plumbing fault, and the answer is the same people standing at the taps.

None of this is a case against the science, which is real and may yet earn a modest and specific place: a tool for certain waste streams, in certain plants, doing a certain job. It is a case against the fairy tale built on top of it. The measures that would slow the crisis are dull and already known. Make less of the stuff. Redesign the packaging we cannot do without so that it can be used again rather than discarded. Build systems of reuse and refill in place of systems of collection. Make the firms that produce plastic pay for the whole of its life, its afterlife included [12,13]. None of this calls for a miracle. All of it calls for us to stop waiting on one. The microbes are not coming to save us. They never had to, because the tools to turn the tide have been in our hands all along, waiting only for us to pick them up.

Bibliography

1. S Yoshida., *et al*. "A bacterium that degrades and assimilates poly (ethylene terephthalate)". *Science* 351 (2016): 1196-1199.
2. H P Austin., *et al*. "Characterization and engineering of a plastic-degrading aromatic polyesterase". *Proceedings of the National Academy of Sciences of the United States of America* 115 (2018): E4350-E4357.
3. V Tournier., *et al*. "An engineered PET depolymerase to break down and recycle plastic bottles". *Nature* 580 (2020): 216-219.
4. H Lu., *et al*. "Machine learning-aided engineering of hydrolases for PET depolymerization". *Nature* 604 (2022): 662-667.
5. R Geyer., *et al*. "Production, use, and fate of all plastics ever made". *Science Advances* 3 (2017): e1700782.
6. R Wei and W Zimmermann. "Microbial enzymes for the recycling of recalcitrant petroleum-based plastics: how far are we?". *Microbial Biotechnology* 10 (2017): 1308-1322.
7. HA Leslie., *et al*. "Discovery and quantification of plastic particle pollution in human blood". *Environment International* 163 (2022): 107199.
8. LC Jenner., *et al*. "Detection of microplastics in human lung tissue using muFTIR spectroscopy". *Science of the Total Environment* 831 (2022): 154907.
9. A Ragusa., *et al*. "Plasticenta: first evidence of microplastics in human placenta". *Environment International* 146 (2021): 106274.
10. JN Hahladakis., *et al*. "An overview of chemical additives present in plastics: migration, release, fate and environmental impact during their use, disposal and recycling". *Journal of Hazardous Materials* 344 (2018): 179-199.
11. K Anderson and G Peters. "The trouble with negative emissions". *Science* 354 (2016): 182-183.
12. W W Y Lau., *et al*. "Evaluating scenarios toward zero plastic pollution". *Science* 369 (2020): 1455-1461.
13. SB Borrelle., *et al*. "Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution". *Science* 369 (2020): 1515-1518.