



by Margaret Wertheim

We all have versions of what a utopian future might be like, but whether it's a cybertech extravaganza or a global-scale, back-to-nature nurturing commune, there's one feature all of us would like to include: a world without pollution. Yet it seems that pollution and technology go hand in

Bacterial feedback



In the war with pollution, biological rescue

hand. No wonder militant greens are often anti-technology and technoheads often impervious to the cries of an ailing planet. Does it have to be a choice between one and the other?

Until very recently, the answer was almost certainly yes, the comforts of industrial civilisation or a future of gas masks and bottled water. But now scientists are beginning to say that there is a way out of this bleak bind. Help has appeared from an entirely unexpected quarter: from nature's most modest representatives, bacteria. Although they seem unlikely saviours, it is to these microscopic creatures that scientists are turning more and more for answers to the world's pollution problems.

One of these scientists is microbiologist Dr Larry Forney, who has become "fascinated by the ability of bacteria to break down plastics". Even though plastics are alien to nature and didn't even exist until a few decades ago, somehow, Forney enthuses, bacteria have learned to eat them. And not just plastics, but countless other chemicals which humans have introduced into the environment. Now, bacteria have evolved which are able to break them down, and Dr Forney and other microbiologists believe that it's possible to harness this ability and use it to realise a world without pollution.

The ultimate goal, Dr Forney says, is not to create any pollution at all. Instead of pumping out waste products into the air, soil and waterways, he envisages a future when industrial waste would be pumped into vats of bacteria which would break it down into biofriendly compounds. Already, he says, "there are groups of people working on finding industrial processes that aren't polluting". Similarly, manufacturers are developing new plastics that can be broken down easily (some are already available). The packaging industry is especially interested in this, since packaging is one of the great sources of waste (and, hence, pollution). With the help of bacteria, Dr Forney believes that we can find ways to eliminate waste altogether. If we do, "pollution will become a purely historical problem".

Dr Forney is associate director of the US National Science Foundation's Center for Microbial Biology. He is leader of a team that is working to understand

how bacteria have been able to evolve so quickly to where they can now deal with the myriad chemicals humans have created. If we can understand this, eventually we should be able to direct

their evolution (for example, they could adapt to break down specific compounds).

The reason bacteria are able to break down man-made waste is because of their role in nature. All organisms, whether bacteria or bison, are based around carbon. Humans derive their carbon from eating plants and animals; bacteria obtain theirs by scavenging. In a compost heap, for instance, they scavenge it from dead leaves (breaking down the leaves in the process). Carbon, a very versatile element, can form many different compounds. All living things are based around carbon, and, because of its versatility, many man-made compounds are also carbon-based. For bacteria, carbon is dinner and they'll get it from wherever they can. Hence, plastics and pesticides are simply the latest in bacteria's haute cuisine.

One of bacteria's primary roles is to keep our planet clean by eating the waste of higher organisms: for example, when we die, our sewerage is consumed by bacteria and, ultimately, they also eat our bodies. The world's soil and waterways teem with millions of varieties of bacteria keeping the planet clean and fit for all of us. They are nature's sanitary squad, the perfect recruits in the fight against manmade muck.

Yet, just as we are discovering how useful they can be in combating pollution, ecologists are discovering that our activities are wiping out untold numbers of them. Although bacteria can evolve very quickly, they don't do it overnight. As we continue to destroy our environment, not only are we endangering spotted owls and marsupials, we could be driving masses of bacteria into extinction. According to Dr Forney, no-one knows what most species even do and scientists have probably catalogued only a small percentage of them. In the battle for a clean planet, they are not only the foot soldiers doing the routine daily chores, but, as Dr Forney and his colleagues are discovering, they are also potentially an elite squad of high-tech specialists. By working with them, we can move towards a world without pollution — but only if we don't wipe them out first. For them to be our saviours, we must also be theirs. ●

