

# NewScientist Archive

[NewScientistArchive](#)[NewScientist.com](#)[NewScientistJobs.com](#)

## Features

**Let a thousand flowers bloom . . .****20 Dec 97****They're heavy metal's biggest fans-and they hang out in the seediest of places. Amy Adams gets a lesson in 90s-style flower power**

A CITYSCAPE, snow, children shrieking with pleasure as they play in the dwindling light of a winter afternoon-the scene could come from countless urban locations. But a few months ago you would not have found kids playing in Maria Carvalho's back yard in a residential suburb of Boston. Nobody knows how, but the land was contaminated with up to three times the recommended safe levels of lead. The heavy metal was poisoning Carvalho's two daughters, but now with the help of some mustard plants they can play in safety. How the yard came to be reborn is the story of an extraordinary collaboration between art and science.

New York sculptor Mel Chin was in search of inspiration. He had spent most of the 1980s building things, now he was looking for a new concept. The hunt led him through a maze of social, political and economic ideas until one day in 1989 he chanced upon an article in the American environmental quarterly, *The Whole Earth Review*, about using jimson weed to clean soil contaminated with heavy metals. It sparked his imagination. Chin had a creative vision of taking contaminated soil and fashioning it into a work of art-clean land. "There is this poetic idea that there is something dead, and through this process it becomes alive again," he says.

There was only one problem: Chin knew nothing about plants. Enter Rufus Chaney, a botanist with a passion for phytoremediation, the process by which plants absorb pollutants from soil. In his lab at a US Department of Agriculture centre in Beltsville, Maryland, Chaney had been testing the abilities of crop plants to tolerate metals. Some, such as turnips, lettuce and lovegrass, die at the merest whiff, while others, including maize and red fescue Merlin, thrive in metal-rich soil.

### Toxic garden

Until then, phytoremediation had been an academic curiosity but, with Chin's help, Chaney saw a way of taking it out of the lab and into the field. Chin's idea was to design a garden or "Revival Field" that would rejuvenate a contaminated industrial site. Chaney suggested using some of his crop plants together with small weeds known for their ability to extract metals from soil. Plants like the white-flowered European alpine pennycress, a member of the mustard family, accumulate toxic metals inside cellular compartments called vacuoles as protection against chewing

insects and infection.

Very little, however, was known about how to increase the metal uptake of such plants, so Chaney suggested varying the conditions under which they were grown so that Chin's work of art would also be a scientific testing ground.

While Chaney pulled together appropriate plant species from around the world, Chin went to work on getting a site. His attention was drawn to the old Pig's Eye landfill in St Paul, Minnesota, near the Walker Art Center where he had some art on display. Until the 1970s, this 120-hectare site had been used as a dump for waste from incinerated sewage sludge, which was contaminated with cadmium and zinc. But before Chin could get to grips with the site, he had to negotiate with politicians, community members and lawyers working for and against the polluting company.

It took almost two years, but in spring 1991 Chin at last began work on the Pig's Eye site. First he had to learn how to garden. But with a few tips from Chaney and some durable gloves and face masks to keep the toxins at bay, Chin and his two assistants created a space for the garden 20 metres square. The design, a circle within a square, had walkways that formed an X, symbolically targeting the site for cleaning. Chin was pleased with the result. "It was illegal to go on this field because of the contamination, but I had to know it might some day be seen."

The pattern contained 96 test areas where maize, Merlin red fescue, bladder campion, alpine pennycress and lettuce-as a control-were grown, using a variety of fertilisers and soil acidifiers. Chaney hoped to identify which fertilisers worked best with each plant to increase growth and the amount of metal absorbed. Acidifying the soil ionises the metals, increasing their solubility and making them easier for plants to absorb.

For the next three years, Chin's assistant Tam Miller tended the garden, adding fertilisers and acidifiers as required and monitoring growth. Each spring the team dug up the plants to analyse their metal content, then replanted the plots.

Alpine pennycress grown at low pH was best at getting rid of zinc and cadmium. Normal plants cannot tolerate more than about 500 parts per million dry weight of zinc, but the pennycress stored up to 25 000 parts per million. Chaney calculated that pennycress could absorb the metal at an annual rate of 125 kilograms per hectare if the soil was acidified to a pH of 5 or 6. So a typical contaminated site might take 16 years to clean. Chaney believes that with the right strain of pennycress, or some genetic tinkering, this could be reduced to four years.

## Second revival

In 1993, with the first Revival Field well under way, Chaney suggested another site to Chin. A zinc smelting plant had left this residential area of Palmerton, Pennsylvania heavily contaminated with zinc and cadmium. This time, people seemed more open to phytoremediation. With help from the Borough Park Commission, the Zinc Corporation of America and the Palmerton Environmental

Task Force, Chin and Chaney created a fan-shaped garden. They tested a different set of fertilisers and soil acidifiers, and they let the plants grow for three full years rather than replanting each year.

Last year, the plants were uprooted. Once again, alpine pennycress led the pack in uptake of zinc and cadmium. And the rate of absorption increased in the second and third years. Building on these findings, Chaney has since analysed 20 strains of alpine pennycress from sites around Europe to identify the most efficient cadmium absorber. He now plans to use it in China, where cadmium contamination is a major health hazard, and has already started work in Eastern Europe.

Chin's gardening days are over. Without funding to continue the project, his Revival Fields are now full of weeds. Even so, he is pleased with the impact of his work. "When I hear from Chaney that companies are starting to sell the idea, I feel like that means it was all worth it," he says. In the past few years, Phytotech, the New Jersey-based company that made the Carvalho's yard safe to play in, has floated rafts of sunflowers to clean uranium-contaminated water around Chernobyl and used pumpkins and mustard plants at the old Magic Marker pen factory site in Trenton, New Jersey. And other phytoremediation companies are springing up

Before Chin's gardens, few people were working on phytoremediation, says Chaney. Now, it's a growing field.

Amy Adams is a freelance writer based in California  
From **New Scientist magazine**, vol 156 issue 2113, 20/12/1997, page 26

© Copyright New Scientist, RBI Limited 2001